

INTERFACE CONTROL DOCUMENT  
FOR  
F-15E AIR VEHICLES/  
RT-1504/ARC-164 UHF HAVE QUICK II  
RECEIVER-TRANSMITTER (MAGNAVOX)

SUBMITTED UNDER F33657-84-C-2228

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CONFIGURATION IDENTIFICATION SHEET

							-201	RT-1504/ARC-164(V) UHF R/T
NO. REQD./ASSY							DASH NO.	PART NAME



1 February 1991

**McDonnell Aircraft Company**1. (U) SCOPE

This Interface Control Document (ICD) defines the interface between the RT-1504/ARC-164 (V) UHF Amplitude Modulation Receiver-Transmitter and the F-15E Air Vehicle, and provides a common data base for the RT-1504/ARC-164 (V) and the F-15E Air Vehicle.

2. (U) APPLICABLE DOCUMENTS

The revisions of issues shown below of the documents listed hereunder form a part of this ICD to the extent invoked by specific reference herein. The applicable revisions or issues of subsidiary documents referenced in the military documents hereunder shall be that revision or issue in effect on 01 May 82. In the event of a conflict between the contents referenced herein and the contents of this ICD, the contents of this ICD shall be a superseding requirement.

2.1 (U) Government DocumentsMilitary Specifications

MIL-B-5087B	Bonding, Electrical and Lightning Protection for Aerospace Systems
MIL-C-39012B (Supp 1A)	Connectors, Coaxial, Radio Frequency, General Specification for
MIL-E-5400K	Electronic Equipment, Airborne, General Specification for
MIL-S-7742	Screw Threads, Standard, General Specification for
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for

Military Standards

MIL-STD-461A, Notices 1,2 and 3	Electromagnetic Interference Characteristics, Requirements for Equipment
MIL-STD-704A	Electric Power, Aircraft Characteristics and Utilization of
MIL-STD-810B	Environmental Test Methods
MIL-STD-45662	Calibration System Requirements

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2.2 (U) Non-Government Documents

MCAIR Report MDC A4246 Rev. A, 3 September 1976	F/TF-15 Vibration, Shock, and Acoustic Design Requirements and Test Procedures for Aircraft Equipment, Update Based on Ground and Flight Test Measurements.
MCAIR Report MDC A4246 Rev. B, 1 November 1985	F/TF-15 Vibration, Shock, and Acoustic Design Requirements and Test Procedures for Aircraft Equipment, Update Based on Ground and Flight Test Measurements.
TBD	Military Specification, Radio Set, RT-1504/ARC-164 (V) UHF Radio Specification
MCAIR Report H417 Rev. D, 21 June 1972	Technical Requirements for Structural Design on F-15 Production Engineering Purchase Contracts.
CP76301A328A083A 15 December 1969	Prime Item Development Specification for F-15 Air Vehicle Avionics Subsystem

3. (U) AIR VEHICLE/RT-1504/ARC-164 RECEIVER TRANSMITTER

The interface between the F-15E Air Vehicle and the RT-1504/ARC-164 (V) UHF Receiver-Transmitter will be as defined herein.

3.1 Mechanical interface. The mechanical interface between the Air Vehicle and the RT-1504/ARC-164 (V) will be as shown in Figure 2. Unless otherwise specified herein, the design and construction of the equipment shall conform to MIL-E-5400.

3.1.1 Unit requirements. The RT-1504/ARC-164 (V) outline, mounting, weight, and center of gravity shall be in accordance with Figure 2. A MCAIR furnished shock mount/thermal shroud is required for the installation of the RT-1504/ARC-164 (V) and is considered part of the F-15E Air Vehicle.

3.1.2 Screws and fasteners. Screws or fasteners which are normally removed or installed during servicing or replacing equipment on the flight line will be subject to MCAIR approval. Screws used to install the system in the aircraft shall be size No. 10 or larger. Mounting provisions shall be designed so that no mounting screws are in bearing. The use of inserts is considered to be threads in bearing. Screw threads shall conform to MIL-S-7742 or MIL-S-8879 as applicable.

3.1.3 Electrical connectors. Connector type, use of potting compounds, and other physical attributes of connectors will be subject to MCAIR approval. Identical connectors will not be used on the LRU in adjacent locations unless a keying and ring assembly is provided.

3.2 Electrical interface. The functional electrical interface characteristics described herein are defined in the input to the using equipment with the specified load attached.

3.2.1 Interconnect wiring. The interconnect wiring shall be as identified herein. Except as specifically noted herein, all the interconnect wiring will be supplied by MCAIR and will be of 26 gauge high strength copper alloy (80% conductivity of pure copper) with 5 mil (FEP) fluorocarbon/polymide insulation.

3.2.2 Signal definition. The RT-1504/ARC-164 utilizes Amplitude Modulation only. The following paragraphs define the electrical signal characteristics of each interface signal.

3.2.2.1 RT-1504/ARC-164 UHF Receiver Transmitter input signals. This section defines the characteristics of the input signals to the ARC-164 (V) from the F-15E interconnecting equipment.

3.2.2.1.1 XMIT AUDIO HI

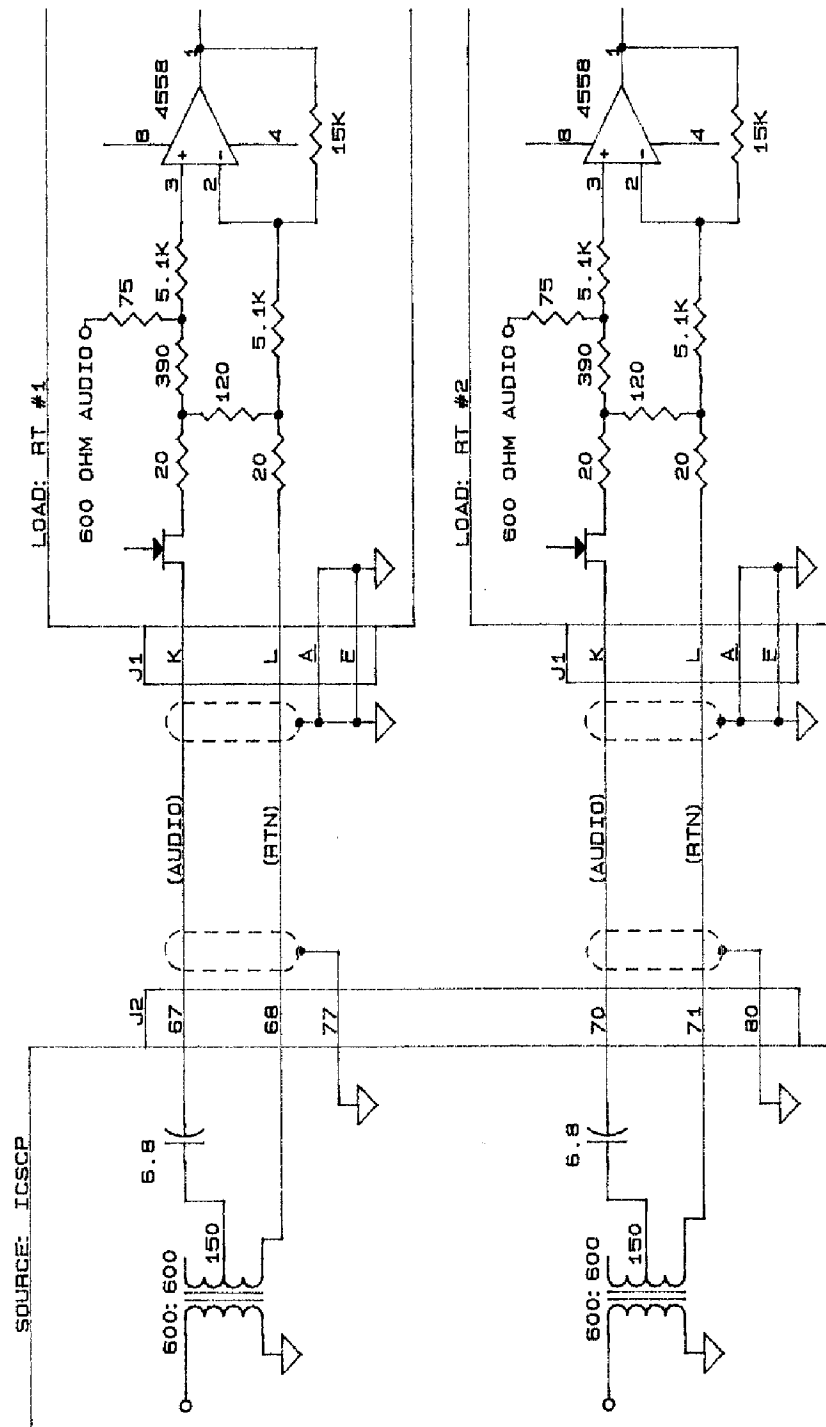
1. SIGNAL TITLE: RT #1 BLACK MOD AUDIO  
RT #2 BLACK MOD AUDIO
2. SIGNAL TYPE: Audio
3. SIGNAL FROM: ICSCP: J2-67 (RT #1)  
ICSCP: J2-70 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-K
5. FUNCTION: Provide narrow-band modulation signal  
to the ARC-164 (V) transmitter
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: 150 Ohms Transformer Output  
LOAD: 150 Ohms Differential Amp
  - b. CURRENT: 40 mA
  - c. INPUT VOLTAGE RANGE: 0.39 - 6.0 Vrms
  - d. MODULATION RANGE: 0 - 100%
  - e. MODULATION CHARACTERISTICS:
    - 1)  $|m| \geq 80\%$  for  $V_i = 1.4 V_{rms}$  @  
1000 Hz; -m linear function  
of  $V_i$  for all  $0 V_{rms} \leq V_i \leq 1.4 V_{rms}$
    - 2)  $80\% \leq |m| \leq 100\%$  for  
 $1.4 V_{rms} \leq V_i \leq 6.0 V_{rms}$  (See NOTE)
  - f. FREQUENCY RANGE: 300 - 3500 Hz
  - g. SHIELDING REQUIREMENTS: Twisted, shielded pair with XMIT  
AUDIO (LO). (See Para. 3.2.2.1.2.)
  - h. SPECIAL REQUIREMENTS: Modulation percentage based upon average RF  
carrier. With an input of 1.0 Vrms between  
300 and 3500 Hz, the demodulated audio  
carrier voltage shall be +1 dB, -3 dB with  
respect to that produced by a 1.0 Vrms input  
voltage @ 1000 Hz.
  - i. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 6.

NOTE: Internal potentiometer A1R35 setting defines the maximum obtainable  $|m|$ . Internal potentiometer A1R21 controls the transmit audio level to the modulator.

3.2.2.1.2 XMIT AUDIO LO

1. SIGNAL TITLE: RT #1 BLACK MOD AUDIO RTN  
RT #2 BLACK MOD AUDIO RTN
2. SIGNAL TYPE: Signal Return
3. SIGNAL FROM: ICSCP: J2-68 (RT #1)  
ICSCP: J2-71 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-L
5. FUNCTION: Provide signal return for  
narrow-band modulation input
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. FREQUENCY RANGE: 300 - 3500 Hz
  - b. SHIELDING REQUIREMENTS: Twisted, shielded pair with XMIT AUDIO (HI)
  - c. SPECIAL REQUIREMENTS: Returns isolated from ground.  
Shields tied to chassis ground at R/T.
  - d. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 6.

SIGNAL NAME: RT #1 BLACK MOD AUDIO/AUDIO RTN  
RT #2 BLACK MOD AUDIO/AUDIO RTN



3.2.2.1.3 SERIAL CLOCK (+)

1. SIGNAL TITLE: UHF #1 CLOCK (+)  
UHF #2 CLOCK (+)
2. SIGNAL TYPE: Digital gated differential square wave
3. SIGNAL FROM: AIU No. 1 J1-48 (RT #1)  
AIU No. 2 J3-110 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-U
5. FUNCTION: Provide the serial CLOCK (+) timing  
to the RT-1504/ARC-164 (V) for serial data  
synchronization.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: AM26LS30 line driver or  
equivalent  
LOAD: 270 Ohms from CLOCK (+) to Ground
  - b. CURRENT: TRUE:  $I_{max} = 40 \text{ mA}$   
FALSE:  $I_{min} < 4 \text{ mA}$
  - c. CLOCK FREQUENCY: 620 Hz  $\pm$  20%
  - d. SHIELDING REQUIREMENTS: Twisted, shielded pair with respect to CLOCK (-).  
Returns isolated from ground. Shields tied to  
chassis and signal grounds at R/T.
  - e. RISE TIME:  $\leq 400 \text{ microseconds}$
  - f. FALL TIME:  $\leq 400 \text{ microseconds}$
  - g. CLOCK PHASING: CLOCK (+) shall be 180 degrees out of phase  
with respect to CLOCK (-). Data transfer  
shall be coincident with the negative going  
portion of CLOCK (+).
  - h. VOLTAGE TRUE:  $\geq 2.4 \text{ VDC}$   
FALSE:  $\leq 0.8 \text{ VDC}$
  - i. SPECIAL REQUIREMENTS: The CLOCK (+) input shall consist of 32  
clock periods followed by a blank period  
equal to 8 clock periods where CLOCK (+) is  
HI. Figure 3 shows typical CLOCK (+) input.
  - j. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 11.

3.2.2.1.4 SERIAL CLOCK (-)

1. SIGNAL TITLE: UHF #1 CLOCK (-)  
UHF #2 CLOCK (-)
2. SIGNAL TYPE: Digital gated differential square wave
3. SIGNAL FROM: AIU1: J1-49 (RT #1)  
AIU2 J3-118 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-V
5. FUNCTION: Provide serial CLOCK (-) timing to  
the RT-1504/ARC-164 (V) for serial data  
synchronization.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: AM26LS30 line driver or equivalent  
LOAD: 270 Ohms from CLOCK (-) to +5 VDC
  - b. CURRENT: TRUE:  $I_{\max} = 40 \text{ mA}$   
FALSE:  $I_{\min} \leq 4 \text{ mA}$
  - c. CLOCK FREQUENCY: 620 Hz  $\pm$  20%
  - d. SHIELDING REQUIREMENTS: Twisted, shielded pair with respect to CLOCK (+).  
Returns isolated from ground. Shields tied to  
chassis and signal grounds at R/T.
  - e. RISE TIME:  $\leq 400 \text{ microseconds}$
  - f. FALL TIME:  $\leq 400 \text{ microseconds}$
  - g. CLOCK PHASING: CLOCK (-) shall be 180 degrees out of  
phase with respect to CLOCK (+).
  - h. VOLTAGE: TRUE:  $\geq 2.4 \text{ VDC}$   
FALSE:  $\leq 0.8 \text{ VDC}$
  - i. SPECIAL REQUIREMENTS: The CLOCK (-) input shall consist of 32  
clock periods followed by a blank period  
equal to 8 clock periods where CLOCK (-) is  
LO. Figure 3 shows typical CLOCK (-) input.
  - j. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 11.

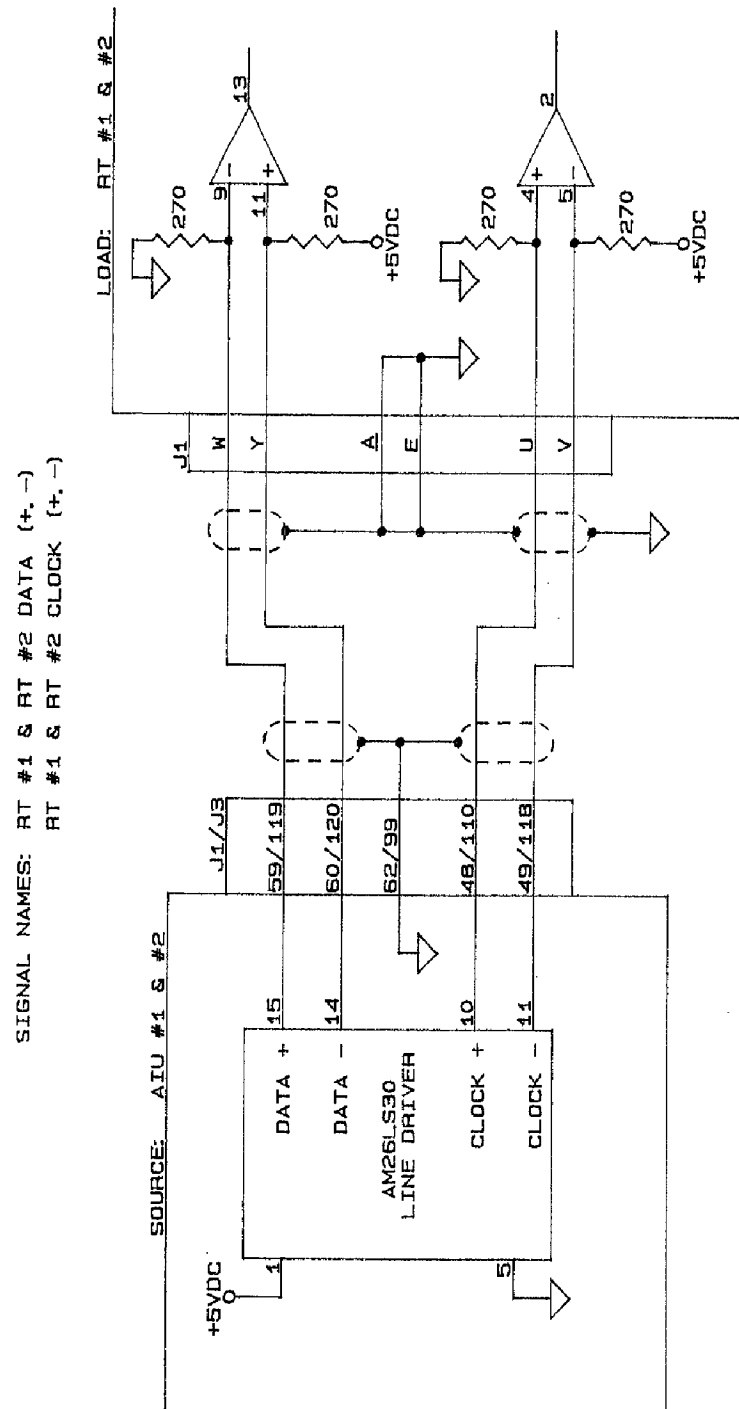
3.2.2.1.5 SERIAL DATA (+)

1. SIGNAL TITLE: UHF #1 DATA (+)  
UHF #2 DATA (+)
2. SIGNAL TYPE: Serial digital differential bi-phase (HI/LO)
3. SIGNAL FROM: AIU1 J1-59 (RT #1)  
AIU2 J3-119 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-W
5. FUNCTION: Provide serial frequency selection,  
bandwidth and mode information to the  
RT-1504/ARC-164 (V) from the AIU
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: AM26LS30 line driver or  
equivalent  
LOAD: 270 Ohms from DATA(+) to Ground
  - b. CURRENT: TRUE:  $I_{max} = 40 \text{ mA}$   
FALSE:  $I_{min} \leq 4 \text{ mA}$
  - c. DATA BIT ID: DATA (+) bit functions are as shown  
on Figure 4.
  - d. SHIELDING REQUIREMENTS: Twisted shielded pair with respect to DATA (-).  
Returns isolated from ground. Shields tied to  
chassis and signal grounds at R/T.
  - e. RISE TIME:  $\leq 400 \text{ microseconds}$
  - f. FALL TIME:  $\leq 400 \text{ microseconds}$
  - g. DATA PHASING: DATA (+) shall be 180 degrees out of  
phase with respect to DATA (-). Data  
transfer shall be coincident with the  
negative going portion of CLOCK (+).
  - h. VOLTAGE LEVELS: TRUE:  $\geq 2.4 \text{ VDC}$   
FALSE:  $\leq 0.8 \text{ VDC}$
  - i. SPECIAL REQUIREMENTS: One data word shall consist of 32 bits  
followed by a blank period equal to 8 clock  
periods where DATA (+) is LO. Figure 3  
shows typical DATA (+) input. The Have  
Quick Data Bit Identification Table is shown  
in Figure 4. The Have Quick Timing Table is  
shown in Figure 5.
  - j. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 11.



3.2.2.1.6 SERIAL DATA (-)

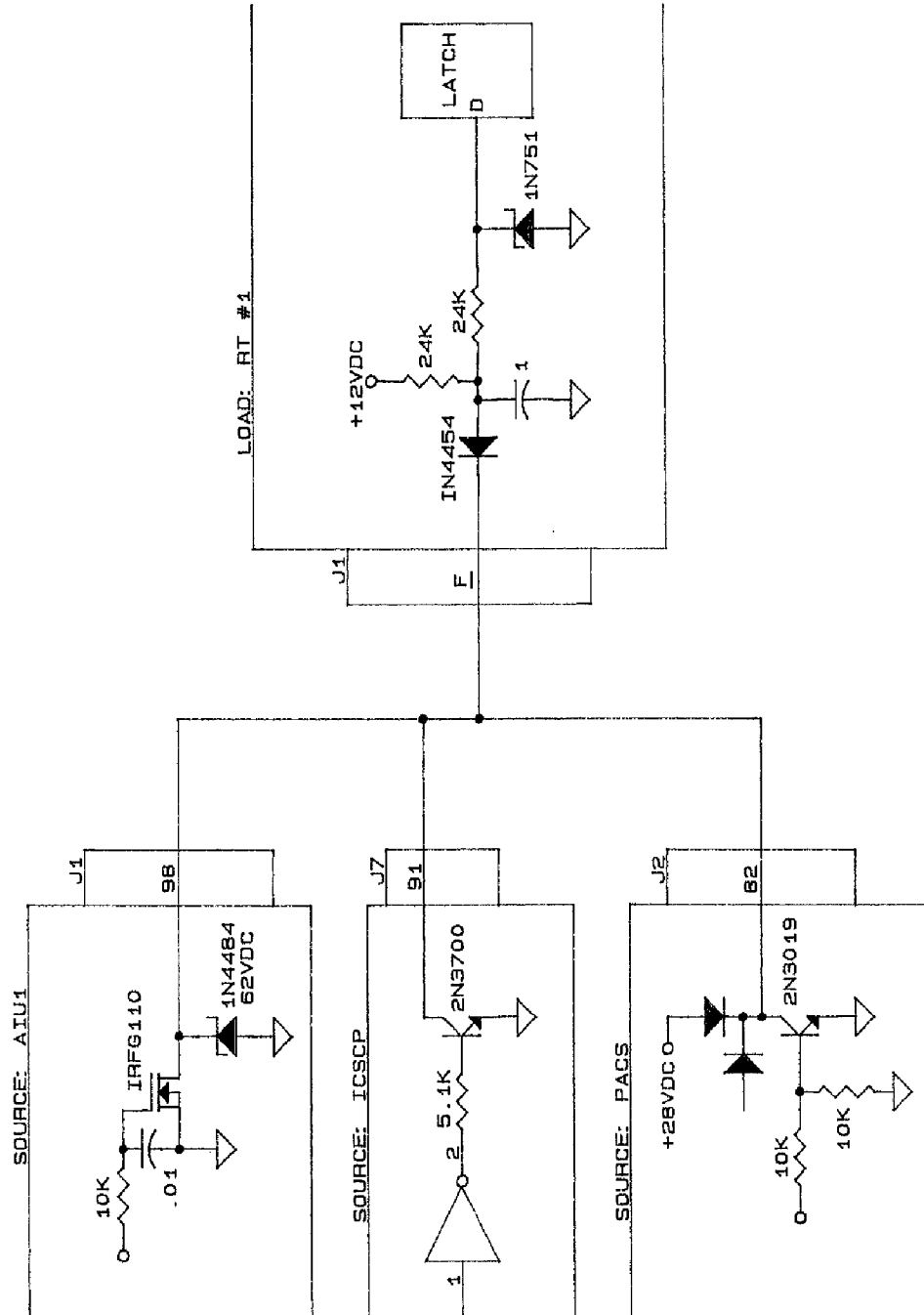
1. SIGNAL TITLE: UHF1 DATA (-)  
UHF2 DATA (-)
2. SIGNAL TYPE: Serial digital differential bi-phase (HI/LO)
3. SIGNAL FROM: AIU1: J1-60 (RT #1)  
AIU2: J3-120 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-Y
5. FUNCTION: Provide serial frequency selection,  
bandwidth and mode information to the  
RT-1504/ARC-164 (V) from the AIU.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: AM26LS30 line driver or  
equivalent  
LOAD: 270 Ohms from DATA (-) to +5 VDC
  - b. CURRENT: TRUE:  $I_{\max} = 40 \text{ mA}$   
FALSE:  $I_{\min} \leq 4 \text{ mA}$
  - c. DATA BIT ID: DATA (-) bit functions are as shown on  
figure 4.
  - d. SHIELDING REQUIREMENTS: Twisted shielded pair with respect to DATA (+).  
Returns isolated from ground. Shields tied to  
chassis and signal grounds at R/T.
  - e. RISE TIME:  $\leq 400 \text{ microseconds}$
  - f. FALL TIME:  $\leq 400 \text{ microseconds}$
  - g. DATA PHASING: DATA (-) shall be 180 degrees out of  
phase with respect to DATA (+). Data  
transfer shall be coincident with the  
negative going portion of CLOCK (+).
  - h. VOLTAGE LEVEL: TRUE:  $\geq 2.4 \text{ VDC}$   
FALSE:  $\leq 0.8 \text{ VDC}$
  - i. SPECIAL REQUIREMENTS: One data word shall consist of 32 bits  
followed by a blank period equal to 8  
clock periods where DATA (-) is HI.  
Figure 3 shows typical DATA (-) input.
  - j. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 11.



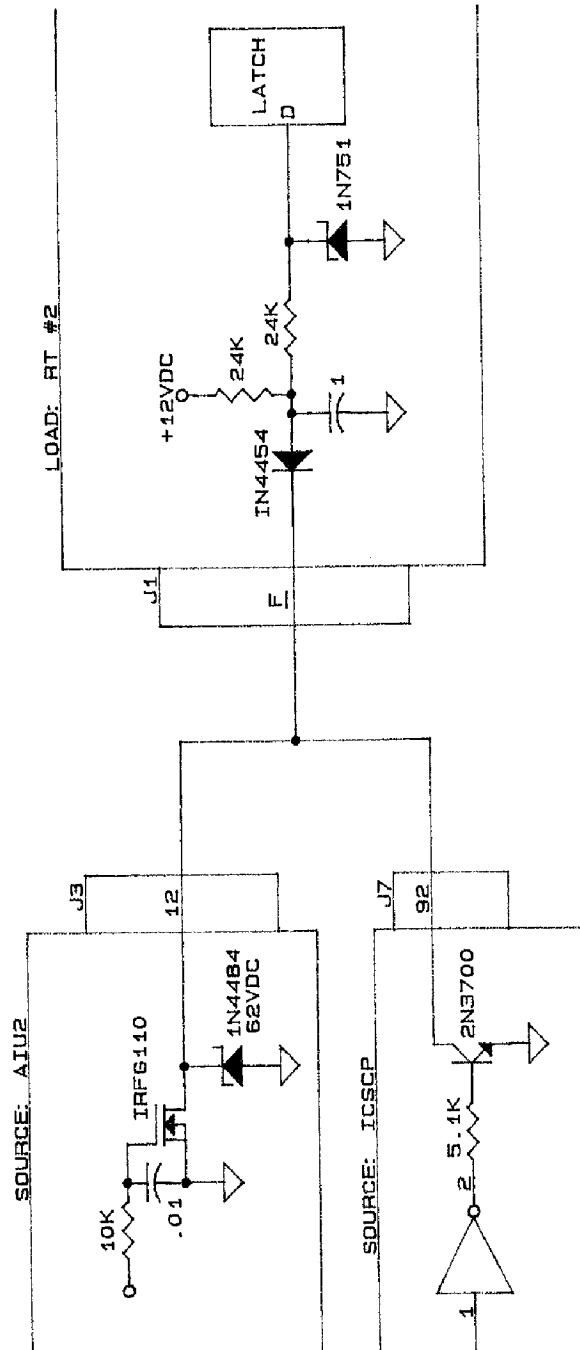
3.2.2.1.7 TONE KEY

1. SIGNAL TITLE: R1 UHF #1 TONE XMIT ENABLE  
R2 UHF #2 TONE XMIT ENABLE
2. SIGNAL TYPE: Discrete Bi-Level (Open/Ground)
3. SIGNAL FROM: AIU1 J1-98 (RT #1), ICSCP J7-91 (RT #1),  
PACS J2-82 (RT #1), AIU2 J3-12 (RT #2),  
ICSCP J7-92 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1- E
5. FUNCTION:
  - 1) The appropriate AIU provides Tone Key control during automatic download of MWOD data. The ICSCP provides Tone Key control during manual download of MWOD data.
  - 2) If not loading a MWOD and a TOD has been loaded, actuating the ICSCP Radio Tone switch or releasing a weapon sets J1-F and J1-H low, causing the TOD to be transmitted followed by a 1 kHz tone.
  - 3) If not loading a MWOD and TOD has not been loaded, actuating the ICSCP Radio Tone switch or releasing a weapon sets J1-F and J1-H low causing only a 1 kHz tone to be transmitted.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING: TRUE: TRANSMIT (Ground) (Tone Key TRUE)  
FALSE: RECEIVE (Open)
  - b. SOURCE IMPEDANCE: TRUE: AIU, ICSCP, PACS Ground  
FALSE: AIU  $\geq 50K$  Ohms: Open FET Drain  
ICSCP, PACS: Open Collector
  - c. LOAD CURRENT: TRUE:  $I_{max} = 8mA$  from RT-1504/ARC-164  
FALSE: Open Circuit
  - d. VOLTAGE: TRUE:  $\leq 1.0$  VDC @ 8 mA. If J1-H is also low, the RT-1504/ARC-164 will transmit a 1 kHz tone.  
FALSE:  $\geq 50k$  ohms (+12 VDC on R/T line) causes RT to operate in receiver mode. Voltage transients shall be  $\leq 60$  VDC. Maximum open circuit voltage from R/T shall be +12 VDC (diode isolated).
  - e. SHIELDING REQUIREMENTS: None
  - f. INTERFACE CIRCUIT: Representative interface circuits for this signal are shown on pages 13 and 14.

SIGNAL NAME: RT #1 TONE XMIT ENABLE



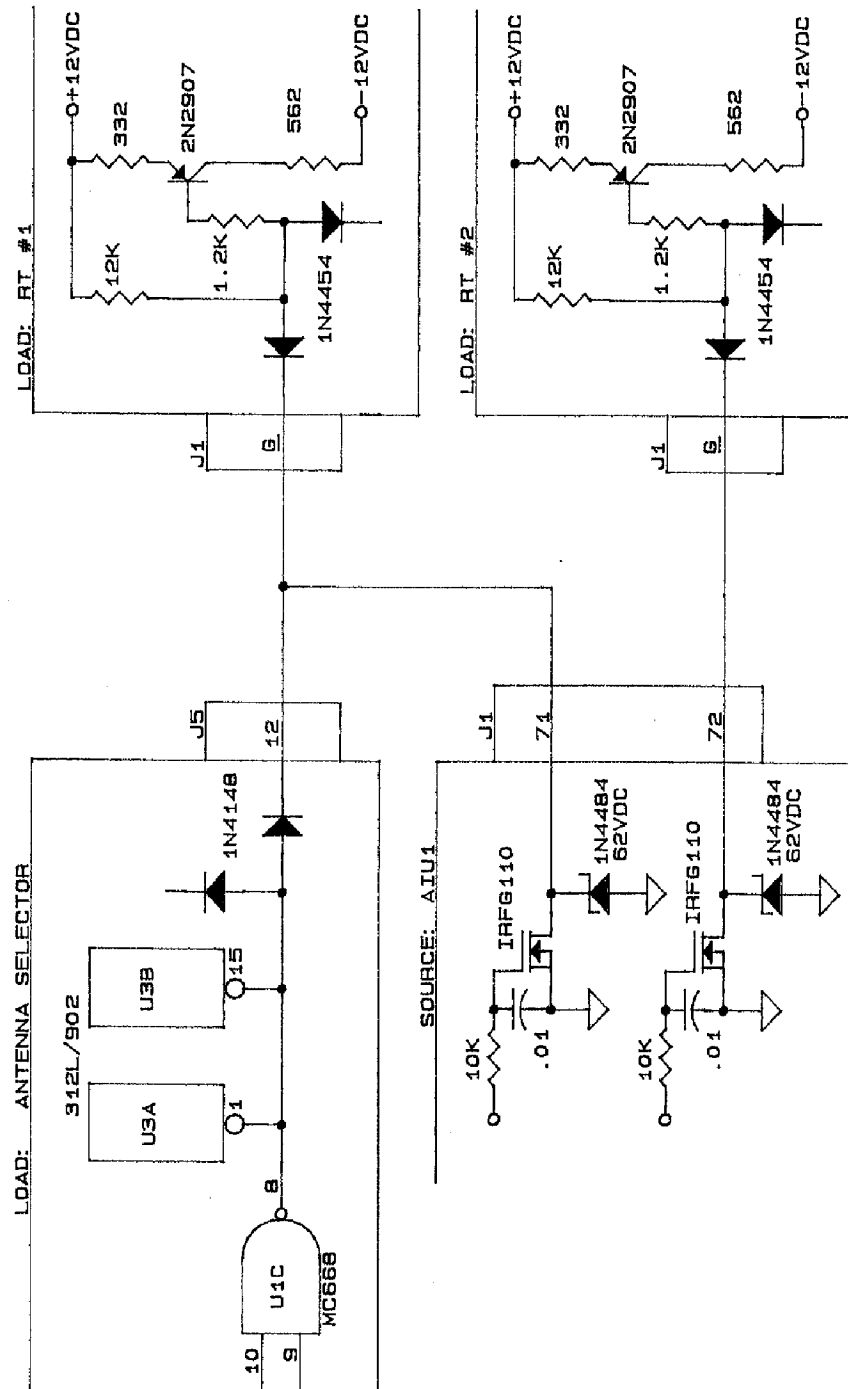
SIGNAL NAME: RT #2 TONE XMIT ENABLE



3.2.2.1.8 X-MODE ENABLE

1. SIGNAL TITLE: RT #1 CIPHER SELECT  
RT #2 CIPHER SELECT
2. SIGNAL TYPE: Discrete Bi-Level (Open/Ground)
3. SIGNAL FROM: AIU1 J1-71 (RT #1)  
AIU1 J1-72 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-G  
ANTENNA SELECTOR J5-12 (RT #1)
5. FUNCTION: Provides bandwidth control for  
the main receiver assembly of the  
RT-1502/ARC-164. Deselects ADF operation.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING: TRUE: X-Mode enabled (Ground)  
FALSE: X-Mode disabled (Open)
  - b. SOURCE IMPEDANCE: TRUE: <2 ohms  
FALSE: >50 kohms (Open FET Drain Circuit)
  - c. LOAD CURRENT: TRUE: I<sub>max</sub> = 5 mA from RT-1504/ARC-164 (V)
  - d. VOLTAGE: TRUE: Ground: ≤ 2.0 VDC @ 4 mA allows  
the main receiver to operate  
narrow band IF mode.  
  
FALSE: Open circuit voltage from  
R/T-1504/ARC-164 (V) diode  
isolated in R/T. Maximum open  
circuit voltage from R/T shall not  
exceed +14 ± 2 VDC.
  - e. FREQUENCY RANGE: DC
  - f. SHIELDING REQUIREMENTS: None
  - g. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 16.

SIGNAL NAME: RT #1 CIPHER SELECT  
RT #2 CIPHER SELECT



3.2.2.1.9 XMIT KEY

1. SIGNAL TITLE: RT #1 TRANSMIT KEY  
RT #2 TRANSMIT KEY
2. SIGNAL TYPE: Discrete Bi-Level (Open/Ground)
3. SIGNAL FROM: ICSCP J7-42 (RT #1)  
ICSCP J7-43 (RT #2)  
PACS J2-81 (RT #1)  
ADF Control Amp (through diode) (RT #1)
4. SIGNAL TO: RT #1 & 2 J1-H  
ANTENNA SELECTOR J5-8 (RT #1)
5. FUNCTION: Grounding the XMIT KEY line causes the RT-1504/ARC-164 to operate in the transmit mode. An open circuit on the XMIT KEY line shall cause the RT-1504/ARC-164 to operate in the receive mode of operation.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING: TRUE: Transmit (Ground)  
FALSE: Receive (Open)
  - b. SOURCE IMPEDANCE: ICSCP, PACS: Open Collector Circuits
  - c. LOAD CURRENT: TRUE:  $I_{max} = 8 \text{ mA}$  from RT-1504/ARC-164  
FALSE: Open Collector Circuit
  - d. VOLTAGE: TRUE: Ground:  $\leq 1.5 \text{ VDC}$  @  $8 \text{ mA}$  causes the RT-1504/ARC-164 to operate in the transmit mode.  
FALSE: Open:  $\geq 50k \text{ ohms}$  (+12 VDC on R/T line) causes RT-1504/ARC-164 to operate in the receive mode. Voltage transients shall be  $\leq 60 \text{ VDC}$ . Maximum open circuit voltage from R/T shall be +12 VDC (diode isolated).



- e. SHIELDING REQUIREMENTS: None
- f. SPECIAL REQUIREMENTS: There shall be no RF power output from the RT-1504/ARC-164 for a minimum of 40 milliseconds after grounding the XMIT Key line. RF power output shall be at least 90% of full RF power output, no less than 60 milliseconds and no greater than 80 milliseconds after grounding the XMIT Key line. RF power shall drop to zero not more than 1 millisecond after ungrounding the XMIT KEY line. Open circuit voltage from RT-1504/ARC-164 in Receive is diode isolated in the R/T.
- g. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 19.

NOTE: When loading a MWOD (Manual or Auto) J1-H is disabled.



3.2.2.1.10 POWER ON/OFF

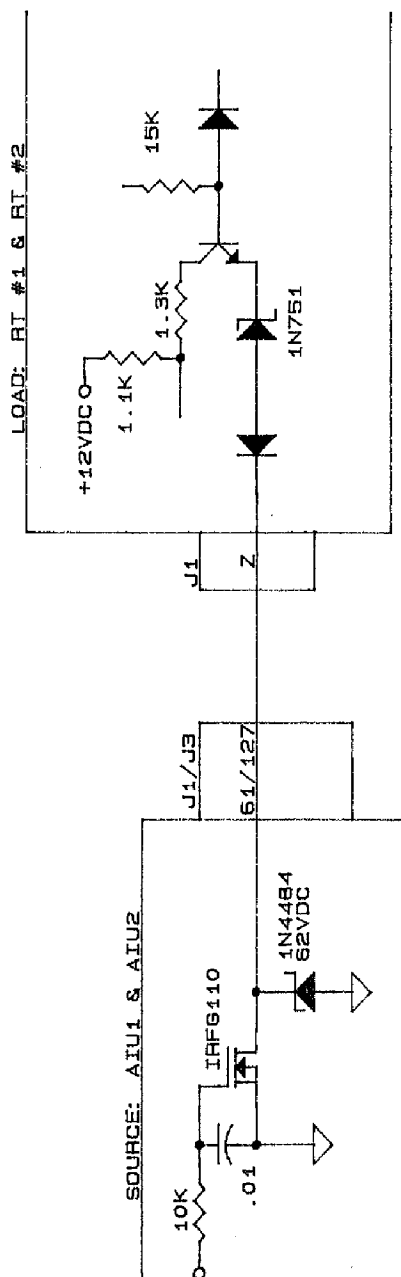
1. SIGNAL TITLE: RT #1 PWR ON/OFF  
RT #2 PWR ON/OFF
2. SIGNAL TYPE: Discrete Bi-Level
3. SIGNAL FROM: AIU1 J1-50 (RT #1)  
AIU2 J3-126 (RT #2)
4. SIGNAL TO: RT #1 & 2: J1-H
5. FUNCTION: Controls application of internal  
electrical power to the RT-1504/ARC-164  
Receiver/Transmitter.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING: TRUE: Power On (Ground)  
FALSE: Power Off (Open)
  - b. SOURCE IMPEDANCE: TRUE: < 2 Ohms  
FALSE: > 50kOhms
  - c. LOAD CURRENT: TRUE:  $I_{max} = 10$  mA from  
RT-1504/ARC-164  
FALSE: Open FET Drain Circuit
  - d. VOLTAGE RANGE: TRUE: Ground:  $\leq 1.5$  VDC @ 5 mA  
applies +28 VDC power to the  
RT-1504/ARC-164.  
  
FALSE: Open,  $\geq 50k$  ohms (+28 VDC from R/T)  
turns off the RT-1504/ARC-164.  
Maximum open circuit voltage from  
R/T shall be +28 VDC.
  - e. FREQUENCY RANGE: DC
  - f. SHIELDING REQUIREMENTS: None
  - g. SPECIAL REQUIREMENTS: Open circuit voltage from RT-1504/ARC-164  
with power OFF is diode isolated in R/T.  
The AIU automatically turns on the radio  
for HQ downloads. It delays 2 seconds for  
auto downloads.
  - h. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 21.



3.2.2.1.11 GUARD ON/OFF

1. SIGNAL TITLE: GUARD RCVR ON/OFF
2. SIGNAL TYPE: Discrete Bi-Level (Open/Ground)
3. SIGNAL FROM:  
AIU1 J1-61  
AIU2 J3-127
4. SIGNAL TO: RT #1 & 2 J1-Z
5. FUNCTION: Grounding the GUARD RCVR ON/OFF line turns on the auxiliary guard receiver in the RT-1504/ARC-164.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING:  
TRUE: Guard Receiver On (Ground)  
FALSE: Guard Receiver Off (Open)
  - b. SOURCE IMPEDANCE:  
TRUE: Ground,  $\leq 2$  Ohms  
FALSE:  $\geq 50k$  Ohms
  - c. LOAD CURRENT:  
TRUE:  $I_{max} = 10$  mA from RT-1504/ARC-164  
FALSE: Open FET Drain Circuit
  - d. VOLTAGE:  
TRUE: Ground:  $\leq 2.0$  VDC @ 3 mA turns the auxiliary guard receiver on.  
  
FALSE:  $\geq 50k$  Ohms (+12 VDC from R/T) turns the auxiliary receiver off.  
Maximum open circuit voltage from R/T shall be +12 VDC (diode isolated).
  - e. FREQUENCY RANGE: DC
  - f. SHIELDING REQUIREMENTS: None
  - g. SPECIAL REQUIREMENTS: Open circuit voltage from the RT-1504/ARC-164 with GUARD OFF is diode isolated in R/T.
  - h. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 23.

SIGNAL NAME: RT #1 GUARD RCVR ON/OFF  
RT #2 GUARD RCVR ON/OFF



3.2.2.1.12 PRIMARY POWER IN

1. SIGNAL TITLE: PRIMARY PWR IN
2. SIGNAL TYPE: +28 VDC
3. SIGNAL FROM: Essential/Main Bus Circuit Breaker  
via UHF Power Line Filter.
4. SIGNAL TO: RT #1 & 2: J1-D
5. FUNCTION: Provides primary DC power to the  
RT-1504/ARC-164 R/T.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CURRENT: 5.35 A max
  - b. VOLTAGE RANGE: 24 to 33 VDC
  - c. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 26.

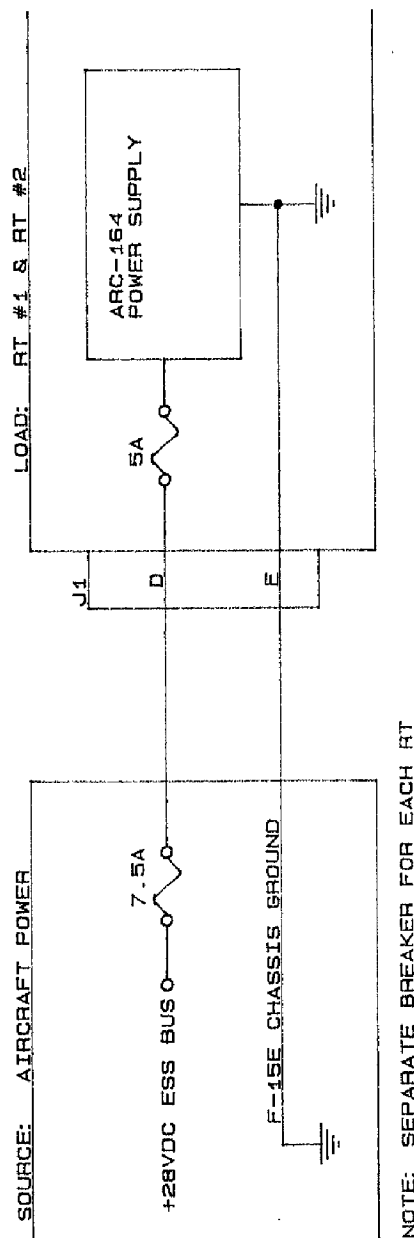
Note: 28 VDC power shall meet the requirements of  
MIL-STD-704A for Category B equipment.

3.2.2.1.13 PRIMARY POWER RETURN

1. SIGNAL TITLE: PRIMARY PWR RTN
2. SIGNAL TYPE: DC Power Return
3. SIGNAL FROM: F-15E Chassis Ground
4. SIGNAL TO: RT #1 & 2: J1-E
5. FUNCTION: Provides ground return for +28VDC  
PRIMARY POWER to RT-1504/ARC-164.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. GROUND:  $\leq 0.1$  Ohms
  - b. SPECIAL REQUIREMENTS: See Para. 3.5.1.1 for primary  
power grounding requirements.
  - c. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 26.



SIGNAL NAME: PRIMARY POWER IN/RETURN



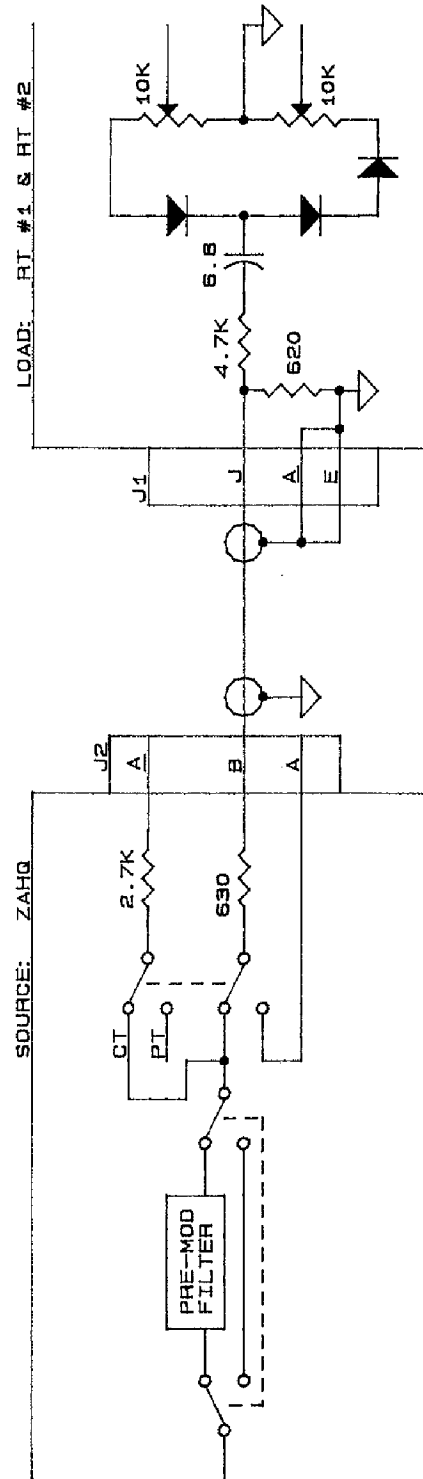
3.2.2.1.14 X-MODE XMIT AUDIO

1. SIGNAL TITLE: WB MODULATION AUDIO
2. SIGNAL TYPE: Audio
3. SIGNAL FROM: ZAHQ J2-B (RT #1 & 2)
4. SIGNAL TO: RT #1 & 2 J1-J
5. FUNCTION: Provide wideband modulation to the RT-1504/ARC-164 from the KY-58 secure speech equipment.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: 780 Ohms unfiltered,  
1680 Ohms filtered  
LOAD: 600 Ohms  $\pm$  20% resistive
  - b. CURRENT:  $I_{max} = 10$  mA
  - c. INPUT VOLTAGE RANGE: 1 to 12 Vp-p (.7 to 4.6  $V_{rms}$ )  
 $V_{in} = 12 [R_L / (R_L + \text{source impedance})]$  NOTE 1
  - d. MODULATION RANGE 0 - 100%
  - e. MODULATION CHARACTERISTICS: 1.4  $V_{rms}$  shall provide at least  $m = +80\%$  @ 1000 Hz. An input 6dB above 1.4  $V_{rms}$  shall result in  $m \leq 100\%$ . NOTE 2
  - f. FREQUENCY RANGE: 70 - 25,000 Hz @ 18,750 bits/sec
  - g. SHIELDING REQUIREMENTS: Shielded single conductor. Shield tied to chassis and signal grounds at R/T.
  - h. SPECIAL REQUIREMENTS: None
  - i. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 28.

NOTE 1: In the aircraft the WB Modulation Audio signals from each radio are tied together resulting in a load of 300 Ohms on the ZAHQ.

NOTE 2: The internal potentiometer A1R35 defines the maximum percent modulation. This potentiometer adjusts the X-MODE Transmit Audio input level. As Transmit Audio is increased past the maximum modulation level, the percentage modulation does not increase, but the modulated signal will go into distortion.

SIGNAL NAME: WB MODULATION AUDIO



3.2.2.2 RT-1504/ARC-164 UHF Receiver Transmitter Output Signals.

This section defines the characteristics of the output signals of the RT-1504/ARC-164 to the F-15 interconnecting equipment.

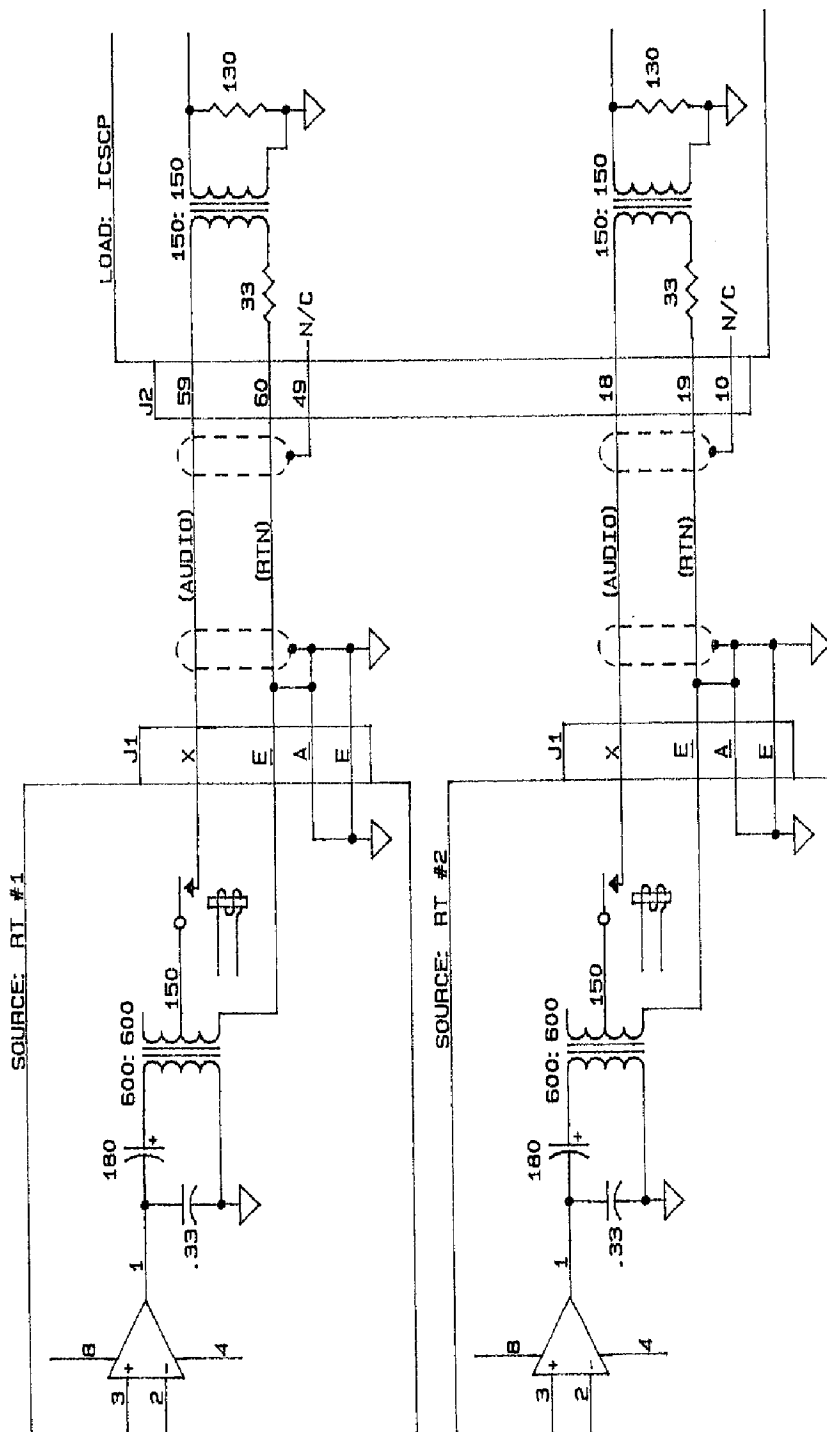
3.2.2.2.1 RECV AUDIO HI

1. SIGNAL TITLE: RT #1 NB Audio  
RT #2 NB Audio
2. SIGNAL TYPE: Audio
3. SIGNAL FROM: RT #1 & 2 J1-X
4. SIGNAL TO: ICSCP J2-59 (RT #1)  
ICSCP J2-18 (RT #2)
5. FUNCTION: Provide 150 Ohm or 600 Ohm (300-3500 Hz)  
narrowband audio output from the  
RT-1504/ARC-164.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE: SOURCE: 150/600 Ohms (300-3500 Hz)  
Resistive  
  
LOAD: 150 Ohms (300-6000 Hz)  
transformer in ICSCP
  - b. CURRENT:  $I_{max} = 50 \text{ mA}$
  - c. VOLTAGE RANGE: 5.20 to 7.35  $V_{rms}$  across 150 Ohms (i.e.  
audio power between .180 and .360 Watts)  
with 1000 microVolt RF Input (Open  
Circuit)  $m = 90\%$  @ 1K Hz.
  - d. FREQUENCY RANGE: 300-3500 Hz
  - e. SHIELDING REQUIREMENTS: Twisted, shielded pair with RECV  
AUDIO (LO). (See Para. 3.2.2.2.2.)
  - f. AUDIO RESPONSE: The Narrowband Audio output response  
between 300 and 3500 Hz shall be within  
+1dB, -3dB with respect to the reference  
level at 1000 Hz. Above 3500 Hz, the  
audio output roll-off shall be 6dB per  
octave or greater.
  - g. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 31.

3.2.2.2.2 RECV AUDIO LO

1. SIGNAL TITLE: RT #1 NB Audio Return  
RT #2 NB Audio Return
2. SIGNAL TYPE: AUDIO
3. SIGNAL TO: ICSCP J2-60 (RT #1)  
ICSCP J2-19 (RT #2)
4. SIGNAL FROM: RT #1 & 2 J1-E
5. FUNCTION: Provide 150/600 Ohm (300-3500 Hz)  
narrowband audio return from ICSCP.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. FREQUENCY RANGE: 300-3500 Hz
  - b. SHIELDING REQUIREMENTS: Twisted, shielded pair with RECV AUDIO (HI).  
This signal is tied to the shield. The shield  
is tied to chassis and signal grounds at R/T.  
NOTE: J1-E must be grounded to receive TOD.
  - c. AUDIO CHARACTERISTICS: See Para. 3.2.2.2.1.
  - d. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 31.

SIGNAL NAME: RT #1 NB AUDIO/RETURN  
RT #2 NB AUDIO/RETURN



3.2.2.2.3 X-MODE RECV AUDIO

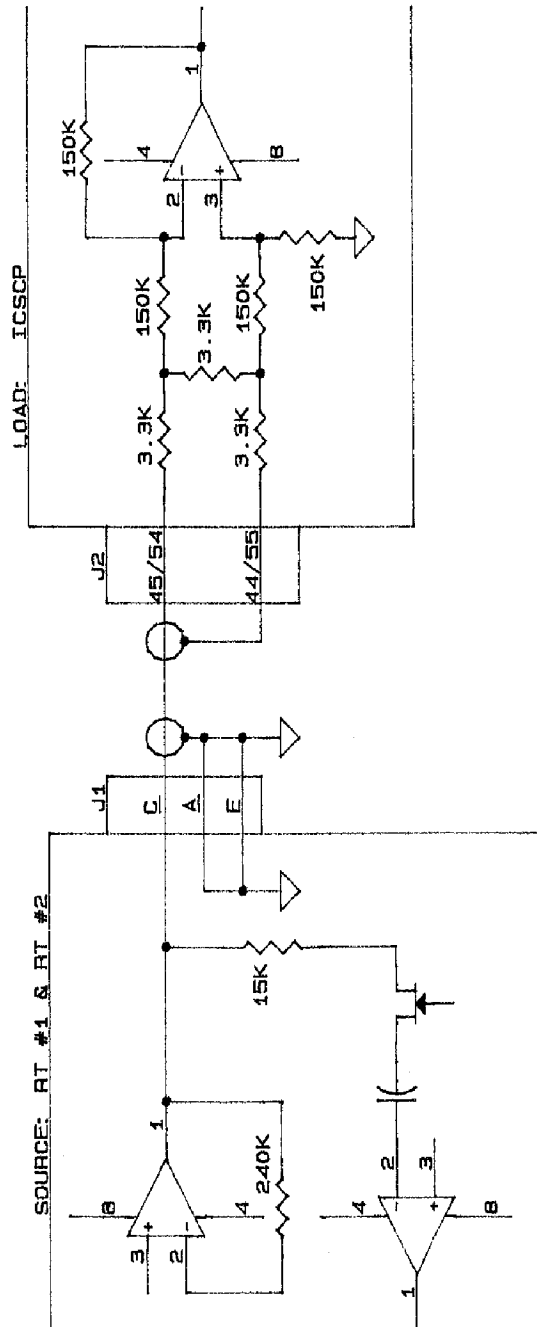
1. SIGNAL TITLE: RT #1 WB Audio  
RT #2 WB Audio
2. SIGNAL TYPE: AUDIO
3. SIGNAL TO: ICSCP J2-45 (RT #1)  
ICSCP J2-54 (RT #2)
4. SIGNAL FROM: RT #1 & 2 J1-Q
5. FUNCTION: Provide 500 Ohm (70-25,000 Hz) audio output from the RT-1504/ARC-164(V).
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE SOURCE: 500 Ohms Resistive  
LOAD: 10K Ohms in ICSCP
  - b. CURRENT: .275 mA minimum
  - c. VOLTAGE RANGE:  $\geq 2.75 V_{rms}$  across 10K Ohms with an RF input of 1000 micro Volts (open circuit)  
m = 90% @ 1000 Hz.
  - d. FREQUENCY RANGE: 70 - 25,000 Hz
  - e. SHIELDING REQUIREMENTS: Single, shielded wire. Shield is tied to chassis and signal grounds at the R/T .
  - f. AUDIO RESPONSE: The wideband audio output shall be + 3 dB between 70 Hz and 20 kHz and +3 dB, -5 dB between 20 kHz and 25 kHz with respect to the reference at 1000 Hz. The audio output from the R/T shall be ahead of the squelch circuit.
  - g. SPECIAL REQUIREMENTS: The time delay through the RT-1504/ARC-164 (V) (from RF antenna input to wideband audio output) shall be between 18 and 42 microseconds. Measurement of the delay shall be made with respect to the negative going portion of the RF signal envelope. The wideband audio return from the ICSCP shall be chassis ground at the R/T.
  - h. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 34.

3.2.2.2.4 SIGNAL GROUND

1. SIGNAL TITLE: WB Audio Return
2. SIGNAL TYPE: Wideband Audio Return
3. SIGNAL FROM: ICSCP J2-44 (RT #1)  
J2-55 (RT #2)
4. SIGNAL TO: RT #1 & 2 J1-A
5. FUNCTION: Provides a return for the Wideband Audio signal (per Para. 3.2.2.2.3) from the ICSCP to the RT-1504/ARC-164. This pin also serves as the signal return for the R/T.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. INPUT IMPEDANCE:  $\leq 0.1$  Ohms
  - b. SHIELDING REQUIREMENTS: This pin is the shield for X-MODE RECV AUDIO (Para. 3.2.2.2.3). Tied to PRIMARY PWR RTN (Para. 3.2.2.1.13) and F-15 Chassis ground external to R/T.
  - c. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 34.



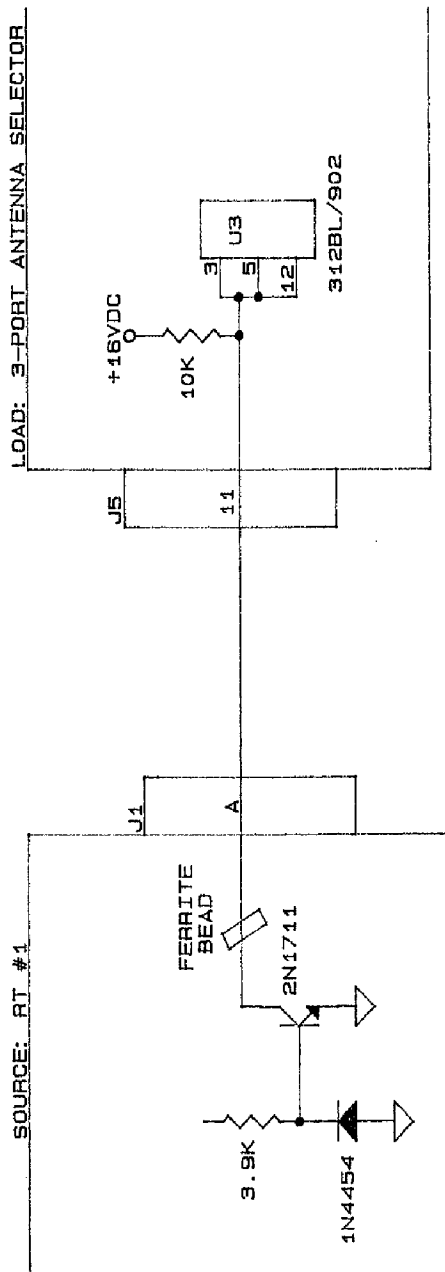
SIGNAL NAME: RT #1 WB AUDIO/RETURN  
RT #2 WB AUDIO/RETURN



3.2.2.2.5 (U) MAIN SQUELCH OUT

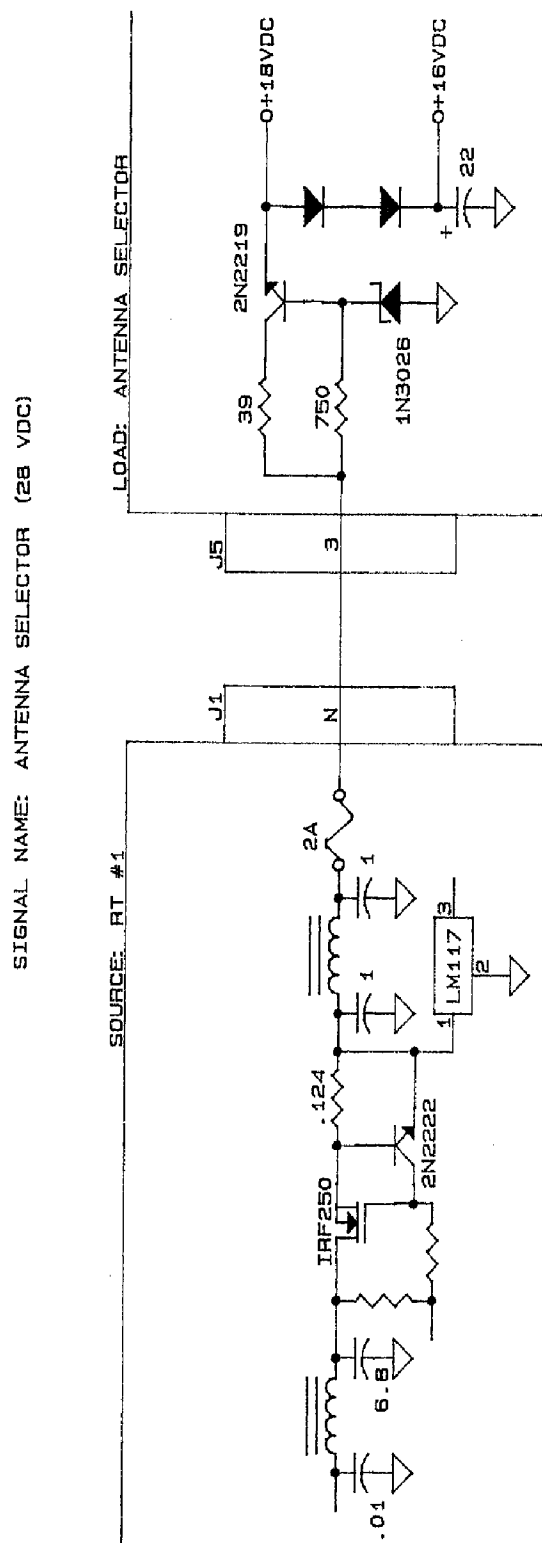
1. SIGNAL TITLE: ANT SELECTOR CONT (SQUELCH ACTIVE)
2. SIGNAL TYPE: Discrete Bi-Level (Open/Ground)
3. SIGNAL TO: 3-port Antenna Selector: J5-11
4. SIGNAL FROM: RT #1 J1-A
5. FUNCTION: Provide an indication to the 3-port Antenna Selector that main receiver squelch of the RT-1504/ARC-164 (V) has been activated.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. CODING: TRUE: Audio Out (R/T unsquelched) (Ground)  
FALSE: No audio out (R/T squelched) (Open)
  - b. IMPEDANCE SOURCE: TRUE:  $\leq .5$  VDC @ 50 mA  
FALSE:  $\geq 50k$  Ohms  
LOAD: +16VDC through 10k Ohms
  - c. CURRENT: TRUE:  $I_{max} = 50$  mA (max. current sink of R/T)  
FALSE: Open Transistor Collector circuit
  - d. VOLTAGE: TRUE: RT #1 & 2 shall provide a ground capable of sinking at least 50 mA @  $\leq .5$  VDC.  
FALSE: Open  
RANGE: 0-30 VDC
  - e. FREQUENCY RANGE: DC
  - f. SHIELDING REQUIREMENTS: NONE
  - g. ATTACK TIME:  $\leq 50$  milliseconds
  - h. RELEASE TIME:  $\leq 150$  milliseconds
  - i. SPECIAL REQUIREMENTS: Voltage transients per MIL-STD-704A
  - j. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 36.

SIGNAL NAME: ANTENNA SELECTOR CONTROL (SQUELCH ACTIVE)



3.2.2.2.6 (U) +28 VDC REG

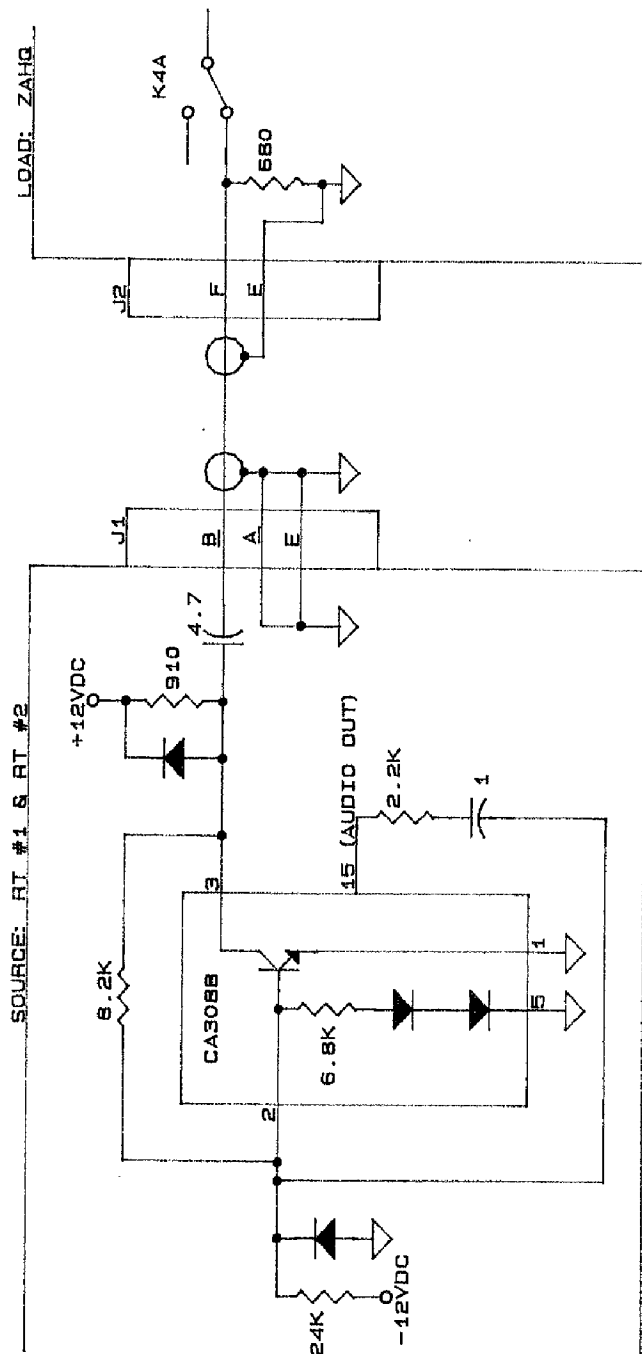
1. SIGNAL TITLE: ANTENNA SELECTOR (28 VDC)
2. SIGNAL TYPE: +27.5 VDC
3. SIGNAL TO: Antenna Selector J5-3 (RT #1)
4. SIGNAL FROM: RT #1 J1-N
5. FUNCTION: Provides switched +27.5 VDC output to the antenna selector after RT-1504/ARC-164 (V) primary power is turned on.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. LOAD IMPEDANCE: +27.5 VDC @ 1 A
  - b. CURRENT:  $I_{max} = 1 \text{ A}$
  - c. VOLTAGE RANGE: 0-27.5 VDC (Transients per MIL-STD-704A)
  - d. FREQUENCY RANGE: DC
  - e. SHIELDING REQUIREMENTS: NONE
  - f. RISE TIME:  $\leq 5 \text{ milliseconds}$
  - g. FALL TIME:  $\leq 1 \text{ milliseconds}$
  - h. SELECTION:
    - SWITCHED  
+27.5 VDC OUT: Grounding the POWER ON/OFF line (see Para. 3.2.2.1.10) shall provide 27.5 VDC output within 5 msec after the ground is applied.
    - NOT SWITCHED  
0 VDC OUT: Ungrounding the POWER ON/OFF line (see Para. 3.2.2.1.10) shall drop +27.5 VDC to 0 VDC within 1 msec after the ground is removed.
  - i. SPECIAL REQUIREMENTS: Voltage transients shall be per MIL-STD-704A.
  - j. INTERFACE CIRCUIT: A representative interface circuit for this signal is shown on page 38.



3.2.2.2.7 (U) GUARD AUDIO

1. SIGNAL TITLE: GUARD AUDIO
2. SIGNAL TYPE: AUDIO
3. SIGNAL TO: ZAHQ J2-F (RT #1 & 2)
4. SIGNAL FROM: RT #1 & 2 J1-B
5. FUNCTION: Provides guard audio from the guard receiver to the KY-58 and allows guard monitoring in cipher mode.
6. NUMBER OF WIRES: 1
7. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE Source: 300 Ohms  $\pm$  20% Resistive (two  
600 Ohms  $\pm$  20% in parallel)  
Load: 680 Ohms Resistive
  - b. CURRENT: I<sub>max</sub> = 50 mA
  - c. VOLTAGE RANGE: 1.0 to 2.0 V<sub>rms</sub> across 300 Ohms with an  
RF input of 1000 Volts (open circuit)  
m = 90% @ 1000 Hz.
  - d. FREQUENCY RANGE: 300 - 3500 Hz
  - e. SHIELDING REQUIREMENTS: Shielded single conductor. Shield tied to  
chassis and signal grounds at R/T.
  - f. AUDIO RESPONSE: The Guard Audio output response between  
300 and 3500 Hz shall be within +1dB, -3dB  
with respect to the reference level at  
1000 Hz. Above 3500 Hz, the audio output  
roll-off shall be 6dB per octave or  
greater.
  - g. INTERFACE CIRCUIT: A representative interface circuit for this  
signal is shown on page 40.

SIGNAL NAME: GUARD AUDIO



3.2.2.3 (U) RT-1504/ARC-164 (V) RF interfaces. This section defines the ARC-164 (V) interfaces that consist of RF input and output signals that use the same transmission line. A simplified block diagram of the F-15E CNI equipment and antennas is shown in Figure 1.

3.2.2.3.1 (U) Antenna Input/Output

1. SIGNAL TITLE: Antenna Input/Output
2. SIGNAL TYPE: Radio Frequency (RF)
3. SIGNAL TO/FROM:

Antenna Selector	J1-1 (RT #1)
RT #1	J2-1
Lower UHF/L-Band Antenna	J1-1 (RT #2)
RT #2	J2-1
4. FUNCTION: Transmit and receive UHF and TACAN transmissions.
5. NUMBER OF WIRES: 1
6. SIGNAL CHARACTERISTICS:
  - a. IMPEDANCE 52 Ohms
  - b. FREQUENCY RANGE: 225.000 to 399.975 MHz
  - c. POWER OUTPUT (ARC-164):  $\geq 10$  Watts
  - d. INPUT VOLTAGE (RANGE): 0-1.5 V<sub>rms</sub> (open circuit)
  - e. VSWR: 2.5 : 1.0 Max.
  - f. SPECIAL REQUIREMENTS: Coaxial cable



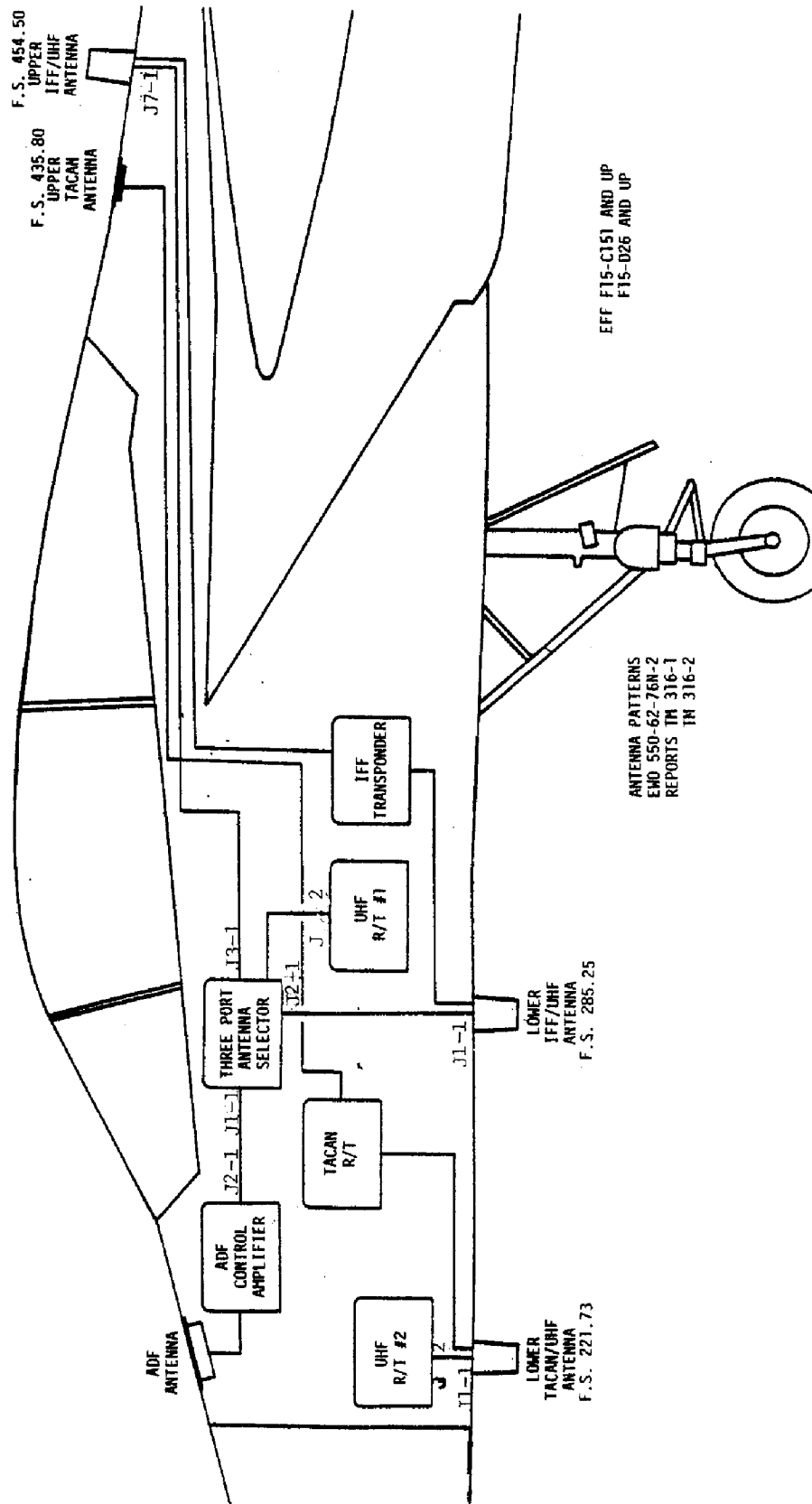


FIGURE 1  
F-15 CNI ANTENNA AND EQUIPMENT  
BLOCK DIAGRAM

3.2.2.4 (U) RT-1504/ARC-164(V) Unused signals - The signals and connector/pin assignments listed below are not used in the F-15E interface.

SIGNAL NAME	CONNECTOR/PIN
SPARE	J1-J
SPARE	J1-B
MAIN AGC	J1-F
GUARD AGC	J1-G
600 OHM XMIT AUDIO IN	J1-M
SPARE	J1-P
RETRANSMIT AUDIO IN	J1-R
SPARE	J1-T
SPARE	J1-D
SPARE	J1-C
CARBON MIC. INPUT	J1-S
GROUND	J3-1
XMIT KEY	J3-2
RECV AUDIO LO	J3-3
RECV AUDIO HI	J3-4
SPARE	J3-5
+27.5VDC	J3-6
SPARE	J3-7
SHIELD GROUND	J3-8
XMIT AUDIO LO	J3-9
XMIT AUDIO HI	J3-10
SPARE	J3-11
SPARE	J3-12
SPARE	J3-13
EXT CLOCK ENABLE	J4-1
SPARE	J4-2
EXT +5.0 VDC	J4-3
SPARE	J4-4
EXT TOD IN	J4-5
EXT CLOCK	J4-6
TOD REQUEST	J4-7
TOD OUT	J4-8
DPTT	J4-9

NOTE: J3 is a Test connector. Signals in connector J4 are not utilized since J4 is blocked by the cooling air shroud. (See Paragraph 3.3.)

3.3 (U) Cooling. The aircraft provides cooling air to each R/T. Air is directed around the LRU by an aluminum shroud that is part of the mounting tray assembly. The cooling interface consists of heat transfer between the LRU and the temperature environment of Paragraph 3.6 and the cooling air as supplied to the LRU from the air vehicle Environmental Control System (ECS). For thermal design considerations there shall be no conduction heat transfer between the LRU and its surroundings. External radiation heat transfer shall not be considered. If analysis shows that radiation heat transfer is required, the interface shall be coordinated with and submitted to MCAIR for approval.

3.3.1 (U) Heat dissipation. The heat dissipation of the RT-1504/ARC-164(V) shall not exceed 150 watts.

3.3.2 (U) Forced Air Cooling. The aircraft shall apply forced air cooling to the external surfaces of the RT-1504/ARC-164(V) as follows:

Humidity. The humidity of the forced cooling air supplied will not exceed 100% relative humidity and will not contain free moisture. In all cases except during transient flight operation, the cooling air temperature/humidity conditions will not be such as to result in condensation within the equipment due to rapid cooling air temperature changes.

Cooling Air Temperature (Continuous Operation). The temperature of the cooling air will be as follows:

Normal Flight Operation	0°F to 40°F
Ground Check-Out Operation	-65°F to 105°F
ECS failure or Ram Air Operation	-65°F to 105°F

Cooling Airflow Rate (Continuous operation). The design flow rate of the cooling air will be as follows:

The R/T shall operate satisfactorily with forced air as specified above over the applicable temperature-altitude range required herein. The R/T shall operate satisfactorily with cooling airflows up to 1.01 lb/min at any of the above cooling air temperatures.

Transient Flight Operation. During transient flight operation the following cooling airflow rates will be supplied:

Temperature	Flowrate
-65°F to 135°F	0.20 lb/min @ -65°F
	0.20 lb/min @ 0°F
	0.30 lb/min @ 85°F
	0.52 lb/min @ 135°F

The R/T shall be capable of satisfactory performance, with some degradation in life allowed, while being supplied with the above cooling airflow rates for durations up to 30 minutes. Conditions prior to these operating conditions shall be based on stabilized continuous flight operation specified above.

3.3.2.1 (U) R/T operation with no cooling air. The R/T shall operate continuously with a 5 minute receive - one minute transmit duty cycle, with no cooling air in an ambient temperature of 60°C and an altitude of 12,000 feet.

3.3.2.2 (U) Thermal protection. The receiver-transmitter shall be protected against overheating. If the receiver-transmitter is operated without sufficient cooling, no damage shall occur.

3.3.3 (U) Pressurization. The equipment will not be pressurized.

3.4 (U) Pilot interface. The controls and displays associated with operation of the two RT-1504/ARC-164(V) radios installed in the F-15E are integrated into equipment that is not defined by this ICD.

3.5 (U) Electromagnetic compatibility. The electromagnetic compatibility interface consists of those features of the RT-1504/ARC-164 (V) and the F/TF-15 Air Vehicle designed to minimize detrimental effects of electromagnetic fields and/or radiation. The RT-1504/ARC-164(V) shall be designed to comply with the requirements of MIL-STD-461 Class 1A as defined in Paragraph 3.3.2.2 of System Specification SS76301A328A001 except that the 1 volt/meter requirement of RS03 is changed to 5 volts/meter except at the channel frequency which shall remain at 1 volt/meter. Also excepted are tests CE04, CE06 and RE02 where the following deviations to MIL-STD-461 specification limits shall apply.

CE04: Connect a line from the Notice 3 broadband spec limit at 0.7 MHz to 96 dB  $\mu$ A/MHz at 0.8 MHz and from there back to the spec limit at 0.9 MHz. This change is applicable only for transients.

CE06: Transmitter harmonics, except the second and third, and all other spurious emissions shall have peak powers 80 dB down from the power at the operating frequency. The second and third harmonics shall be suppressed by  $40 + 10 \log P$  dB; where P = Peak Power in Watts at the operating frequency.

RE02: Narrowband limit. A line should be drawn from the original limit at 40 kHz to 48 dB $\mu$ V/m at 45 kHz and from there back to the original limit at 50 kHz.

AFCS Design Handbook 1-4 Electromagnetic Compatibility shall be used as a design guide.

3.5.1 (U) Grounding characteristics. The RT-1504/ARC-164(V) will be grounded in a manner which will prevent ground loops and ground returns common to signal and power circuits, and will provide effective shielding for signal circuits, minimize EMI, and protect personnel from electrical hazards. To provide grounding consistency the following items shall apply.

3.5.1.1 (U) Primary Power grounding. For grounding purposes, primary power is defined as electrical power which is conducted from aircraft generators or power supplies. Raw primary power is defined to include aircraft bus power which is fused or switched, and attenuated primary power is defined to include aircraft bus power which is filtered, regulated or otherwise attenuated.

3.5.1.2 (U) Secondary power and signal grounding. Secondary power is defined as electrical power, which is isolated from primary power by a transformer. A signal is defined as electrical energy which contains information.

To ensure adequate rejection of aircraft chassis noise, the secondary power and signals conducted from one LRU to another shall not utilize aircraft structure as a return or the loads shall be balanced with

respect to aircraft chassis such that equipment performance will not be degraded by the noise listed below. As a minimum, all signal loads, excluding discretes, shall be balanced within 95 percent. Discrete signals (non-digital two-state signals) may use aircraft structure return provided that they are thresholded to function properly when subjected to the noise listed below. A signal source may be unbalanced provided that it is of sufficiently low impedance to avoid unbalancing the circuit beyond the noise tolerance limits listed below. Otherwise the source must be balanced. If an existing signal load is unbalanced, then the signal source must be isolated from aircraft chassis by an impedance that is large enough to ensure performance under the conditions listed below.

All interface circuits shall be capable of specified performance when subjected to the aircraft chassis noise existing between the two LRU's as specified below:

- a. 3  $V_{rms}$  from 380 Hz to 420 Hz.
- b. 1  $V_{rms}$  from 500 Hz to 100 MHz.
- c. +8 Volts and -8 Volts for a spike (100  $\mu$ sec pulse width, 100 pulses per second)

Signal and secondary power circuits between LRU's may share return wires with other circuits only where approved by MCAIR. Analog video and other wideband analog (non-digital) signals conducted from one LRU to another and with information frequency content above 1 MHz shall be conducted between line-replaceable units on triax or twinax with corresponding triax or twinax matches the characteristic impedance of the line.

RF or IF carriers above 1 MHz which are conducted to antennas or to receivers with a skirt selectivity of at least 80 dB one decade out of band may be referenced to chassis at each end and may be impedance matched to the transmission line.

3.5.1.3 (U) Shield grounding. The connector pins shall be grounded to the equipment chassis by the shortest means practicable.

3.5.1.4 (U) Chassis ground. For safety purposes one internally grounded pin shall be provided on each connector containing pins for primary power.

3.5.1.5 (U) Component grounds. All externally exposed metal parts, shields, control shafts, switch handles, connectors and bushings shall be grounded to the chassis.

3.5.1.6 (U) Bonding. The means of electrically bonding the equipment to the aircraft chassis shall be considered an interface with the aircraft. The design must have MCAIR approval and must comply with the requirements of MIL-B-5087 and MCAIR Process Specification 17169. Reference Figure 2 for mounting interface bonding requirements.

3.5.2 (U) RF transmitter/receiver compatibility. The RT-1504/ARC-164(V) receiver/transmitter must be compatible with other RF transmitters on board the F/TF-15 air vehicle.

3.6 (U) Environmental conditions. The equipment shall meet all specified operating requirements and shall provide required performance, life and reliability when operated within the airframe and subsystem flight envelope given in Figure 17 of CP76301A328A020A.

3.6.1 (U) Shock. Service shock and crash safety shock Region 1 of Document MDC A4246, Rev. A is applicable.

3.6.2 (U) Design loads. The equipment, when installed in the aircraft, shall be designed for limit and ultimate loads.

Sign Convention

Forces from (+) vertical load factor act down.  
Forces from (+) longitudinal load factor act aft.  
Forces from (+) lateral load factor act toward left side.

3.6.2.1 (U) Limit Load Factors. The equipment shall meet all performance requirements before, during and after exposure to limit loads. No physical distortion or permanent set of the equipment is permitted after application of limit loads.

Limit Load Factors (G's)

<u>Condition</u>	<u>Vertical</u>	<u>Longitudinal</u>	<u>Lateral</u>
A	13.4	- 0.3	±8.3
B	9.6	- 7.9	±3.8
C	-5.8	- 0.2	±6.3
D	4.3	-12.2	±4.8
E	1.0	- 4.9	±9.7
F	-3.0	- 9.2	±3.9

3.6.2.2 (U) Ultimate loads. This shall withstand ultimate load factors with no failure of the structural supporting elements and the equipment shall remain in place. Distortion and permanent set are permitted and equipment operation is not required during or after application of ultimate loads

<u>Condition</u>	<u>Vertical</u>	<u>Longitudinal</u>	<u>Lateral</u>
A	20.1	- 0.5	±12.5
B	14.4	-11.9	± 5.7
C	-8.7	- 0.3	± 9.5
D	6.5	-18.3	± 7.2
E	1.5	- 7.4	±14.6
F	-4.5	-13.8	± 5.9

3.6.2.3 (U) Crash loads. Not applicable.

3.6.3 (U) Vibration. Document No. MDC A4246 is applicable to random vibration conditions for isolated equipment as defined below.

3.6.3.1 (U) Non-gunfire vibration. Non-gunfire Vibration - Region 2 of MDC A4246, Rev. A is applicable.

3.6.3.2 (U) Gunfire vibration. Gunfire Vibration - Region 12A of MDC A4246, Rev. B is applicable. This equipment shall perform during and after exposure to gunfire vibration.

3.6.3.3 (U) Minimum integrity. Minimum integrity - A 30 minute test per axis, hard mounted, for the following spectrum:

5-20 Hz 6dB/octave  
20-800 Hz 0.04 g<sup>2</sup>/Hz  
800-200 Hz -9 dB/octave

3.6.4 (U) Acoustic noise. Acoustic noise design conditions of Document MDC A4246, Rev. A are applicable. The appropriate zones are as follows:

3.6.4.1 (U) Non-gunfire Acoustic Noise. Non-gunfire, Zone 1 is applicable.

3.6.4.2 (U) Gunfire Acoustic Noise. Gunfire, Zone 9 is applicable. The equipment shall perform during and after exposure to gunfire noise.

3.6.5 (U) Temperature-altitude. Temperature-altitude conditions of 3.2.5.1 of CP76301A328A083 and shown in Figure 6 for continuous and transient operation are applicable.

3.6.6 (U) Explosive atmosphere. The requirements of 3.2.24.10 of MIL-E-5400 are applicable.

3.6.7 (U) Humidity. The requirements of 3.2.24.4 of MIL-E-5400 are applicable.

3.6.8 (U) Salt atmosphere. The requirements of 3.2.24.9 of MIL-E-5400 are applicable.

3.6.9 (U) Fungus. The requirements of 3.2.24.8 of MIL-E-5400 are applicable.



3.6.10 (U) Sand and dust. The requirements of 3.2.4.7 of MIL-E-5400 are applicable.

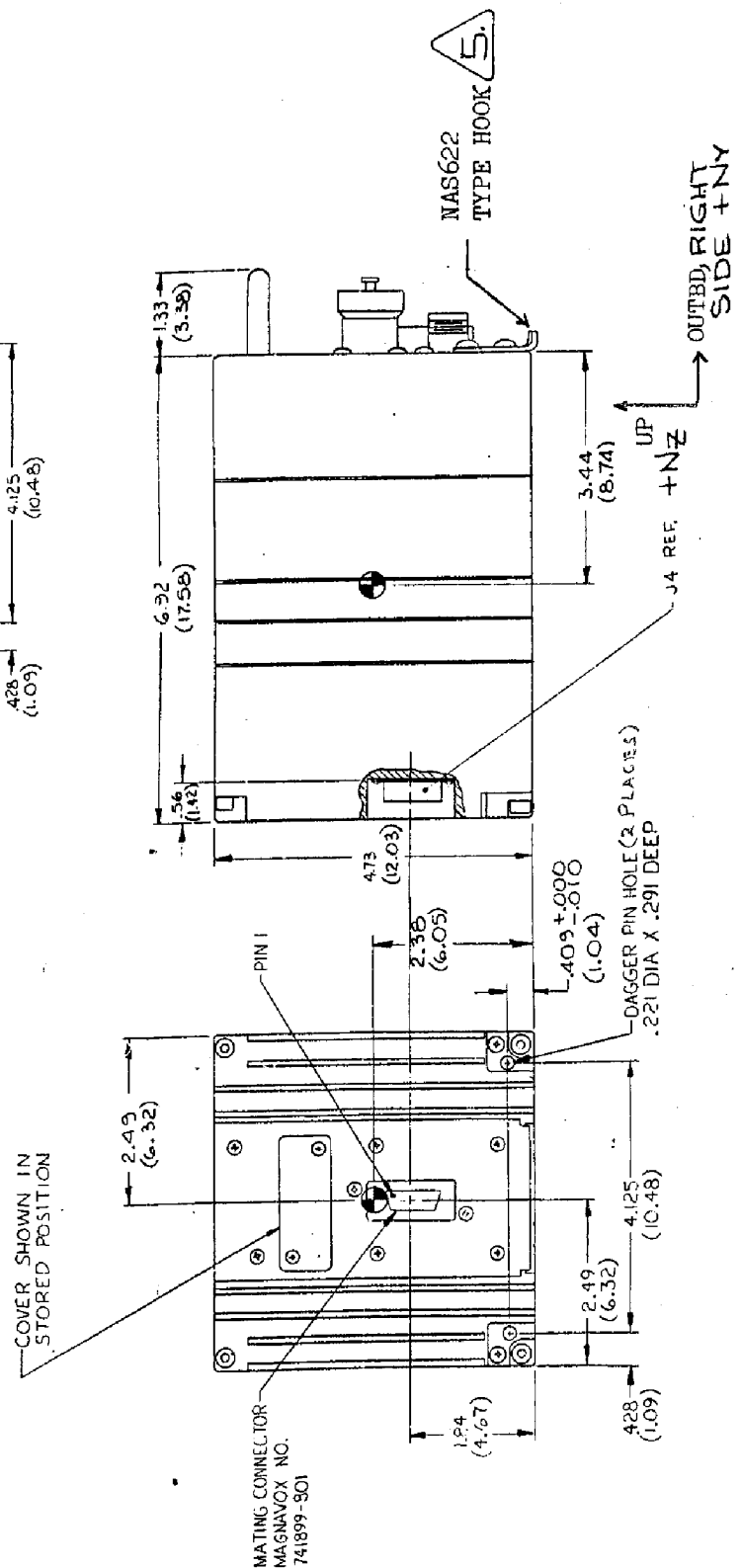
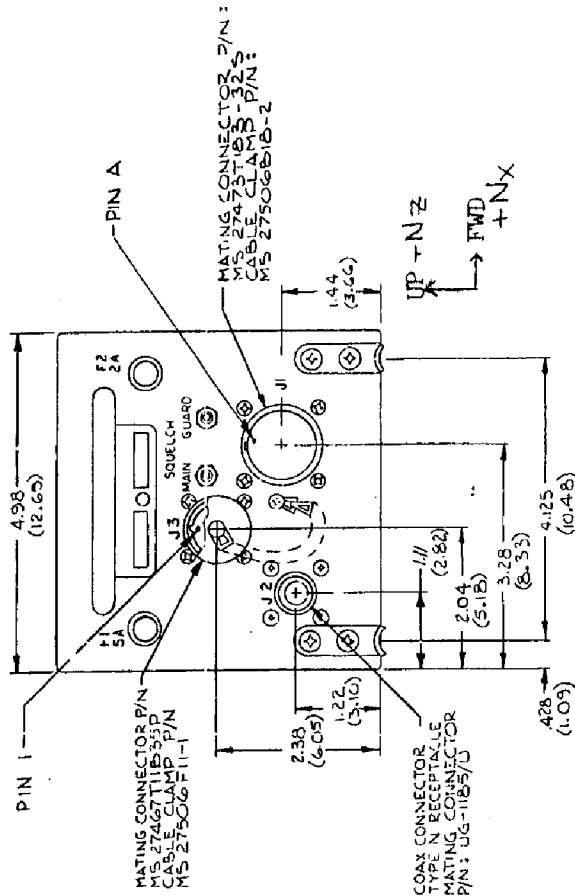
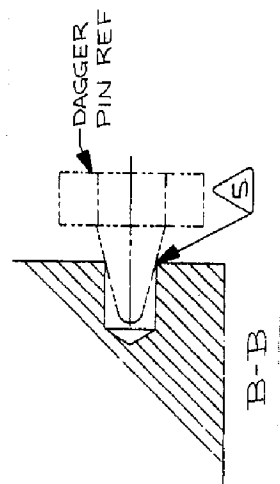
3.7 (U) Design and Construction. Design and construction of the equipment shall conform with Paragraph 3.2 of MIL-E-5400 and MCAIR Report H417.

3.7.1 (U) Strength. The equipment shall be designed in accordance with the strength requirements of MCAIR Report H417 and shall be capable of withstanding the loads and environments in this document.

3.7.2 (U) Fatigue design consideration. All elements of detail design shall be properly considered in accordance with MCAIR Report H417 in order to insure maximum fatigue life.

3.7.3 (U) Materials, processes and parts. Materials, processes, and parts shall meet requirements of Section 3.1 of MIL-E-5400 and MCAIR Report H417.

1. Tolerances unless otherwise specified:  
.XX + .03 .XXX + .010
2.  Denotes approximate center of gravity
3. Unit Weight: 8.5 Pounds Max.
4. Pinhole shall be electrically clean and compatible with stainless steel.
5.  Bonding shall be per MIL-B-5087B Class R.

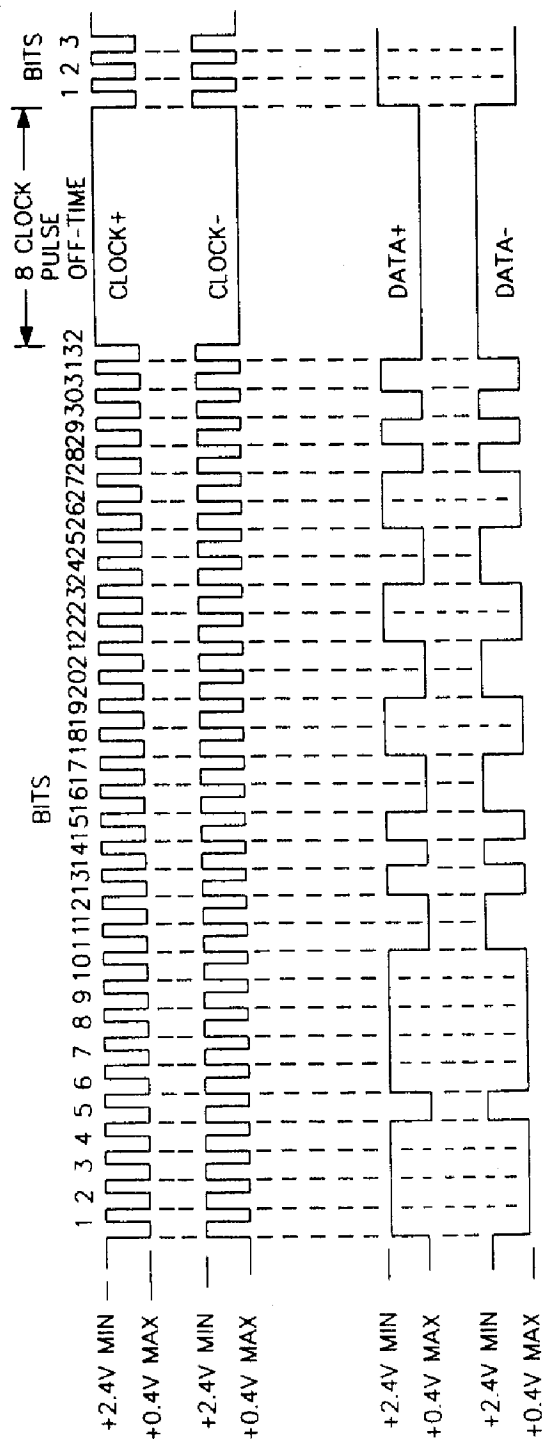


RT-1504/ARC-164(V) Receiver-Transmitter

Figure 2

**MCDONNELL DOUGLAS**





NOTES: 1. DATA BITS CHANGE ON NEGATIVE-GOING EDGES OF CLOCK+OUTPUT

2. BIT 1 IS FIRST BIT OUT OF REGISTER.

3. CLOCK FREQUENCY = 620 HZ  $\pm 20\%$

4. CONDITIONS DESCRIBED BY DATA BITS ABOVE:

(A) MANUAL MODE

(B) PRESET CHANNEL SELECT SWITCH AT 5

(C) MANUAL OPERATING FREQUENCY SELECTED - 299.975 MHZ

(D) NB/WB SWITCH IN NB (NB-WB INPUT HIGH, LOGIC 1)

(E) SQUELCH ON/OFF SWITCH IN OFF (SQUELCH ON-OFF INPUT LOW, LOGIC 0)

Figure 3

Clock and Data Inputs

**MCDONNELL DOUGLAS**

## RT-1504/ARC-164

BIT NO.	LOGIC	LVL	DATA(+)	DATA(-)	FUNCTION	DATA & OUTPUT DESCRIPTION
1	NEGATIVE	LO	HI	RT Channel 1	0 for Chan 1/11; 1 for all other	
2	NEGATIVE	LO	HI	RT Channel 2	0 for Chan 2/12; 1 for all other	
3	NEGATIVE	LO	HI	RT Channel 3	0 for Chan 3/13; 1 for all other	
4	NEGATIVE	LO	HI	RT Channel 4	0 for Chan 4/14; 1 for all other	
5	NEGATIVE	LO	HI	RT Channel 5	0 for Chan 5/15; 1 for all other	
6	NEGATIVE	LO	HI	RT Channel 6	0 for Chan 6/16; 1 for all other	
7	NEGATIVE	LO	HI	RT Channel 7	0 for Chan 7/17; 1 for all other	
8	NEGATIVE	LO	HI	RT Channel 8	0 for Chan 8/18; 1 for all other	
9	NEGATIVE	LO	HI	RT Channel 9	0 for Chan 9/19; 1 for all other	
10	NEGATIVE	LO	HI	RT Channel 10	0 for Chan 10/00; 1 for all other	
11	NEGATIVE	LO	HI	RT Channel 11	0 for Chan 1-9 and 00; 1 Chan 10-19	
12	NEGATIVE	LO	HI	Mode	0 for Manual and Have Quick; 1 for Manual and Channel	
13	NEGATIVE	LO	HI	Mode	0 for Guard and Have Quick; 1 for Manual and Channel	
14	POSITIVE	HI	LO	200/300MHz	0 for 200; 1 for 300	
15	POSITIVE	HI	LO	10 MHz	Positive Logic BCD	
16	POSITIVE	HI	LO	20 MHz		
17	POSITIVE	HI	LO	40 MHz		
18	POSITIVE	HI	LO	80 MHz		
19	POSITIVE	HI	LO	1 MHz		
20	POSITIVE	HI	LO	2 MHz		
21	POSITIVE	HI	LO	4 MHz		
22	POSITIVE	HI	LO	8 MHz		
23	POSITIVE	HI	LO	0.1 MHz		
24	POSITIVE	HI	LO	0.2 MHz		
25	POSITIVE	HI	LO	0.4 MHz	0 for .000 & .025; 1 for .050 & .075	
26	POSITIVE	HI	LO	0.8 MHz		
27	POSITIVE	HI	LO	0.05 MHz	1 for .000/.050; 0 for .025 & .075	
28	NEGATIVE	LO	HI	0.025 MHz	0 for WB; 1 for NB (Note 1)	
29	NEGATIVE	LO	HI	WB/NB	0 for HQ Mode T; 1 for HQ Mode AC or AM (Note 2)	
				HQ-T/HQ-A	0 for disable; 1 for enable	
30	NEGATIVE	LO	HI	Squelch Disable	1 for enable (Note 3)	
31	POSITIVE	HI	LO	Spare	Fixed to 1	
32	POSITIVE	HI	LO	Spare	0 fixed for all radios	

- NOTES: 1 AIU shall control the WB/NB selection.  
 2 Valid for RT #1 when Bits 12 and 13 are both "0".  
 3 AIU shall keep this bit enabled.

Figure 4

Data Bit Identification  
 RT-1504/ARC-164

Channel/Frequency		Duration	Channel/Manual	
HQ LOAD	20 220.025	500 $\pm$ 100 msec	Channel	----
WOD1 SEGMENT 1	20 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 2	19 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 3	18 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 4	17 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 5	16 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 6	15 ###.###	275 + 100, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
WOD1 SEGMENT 7	14 ###.###	275 + 500, -50 msec	Manual	
TONE		150 $\pm$ 50 msec	Manual	
OPER/VER	20 220.000	500 $\pm$ 100 msec	Channel	
NORMAL		as currently implemented		

Repeat for  
each WOD  
(up to 6  
total  
copies)

NOTE: Tone is applied when segment timing is complete and must be removed before application of next segment.

FIGURE 5  
AUTOMATIC MWOD DOWNLOAD TIMING

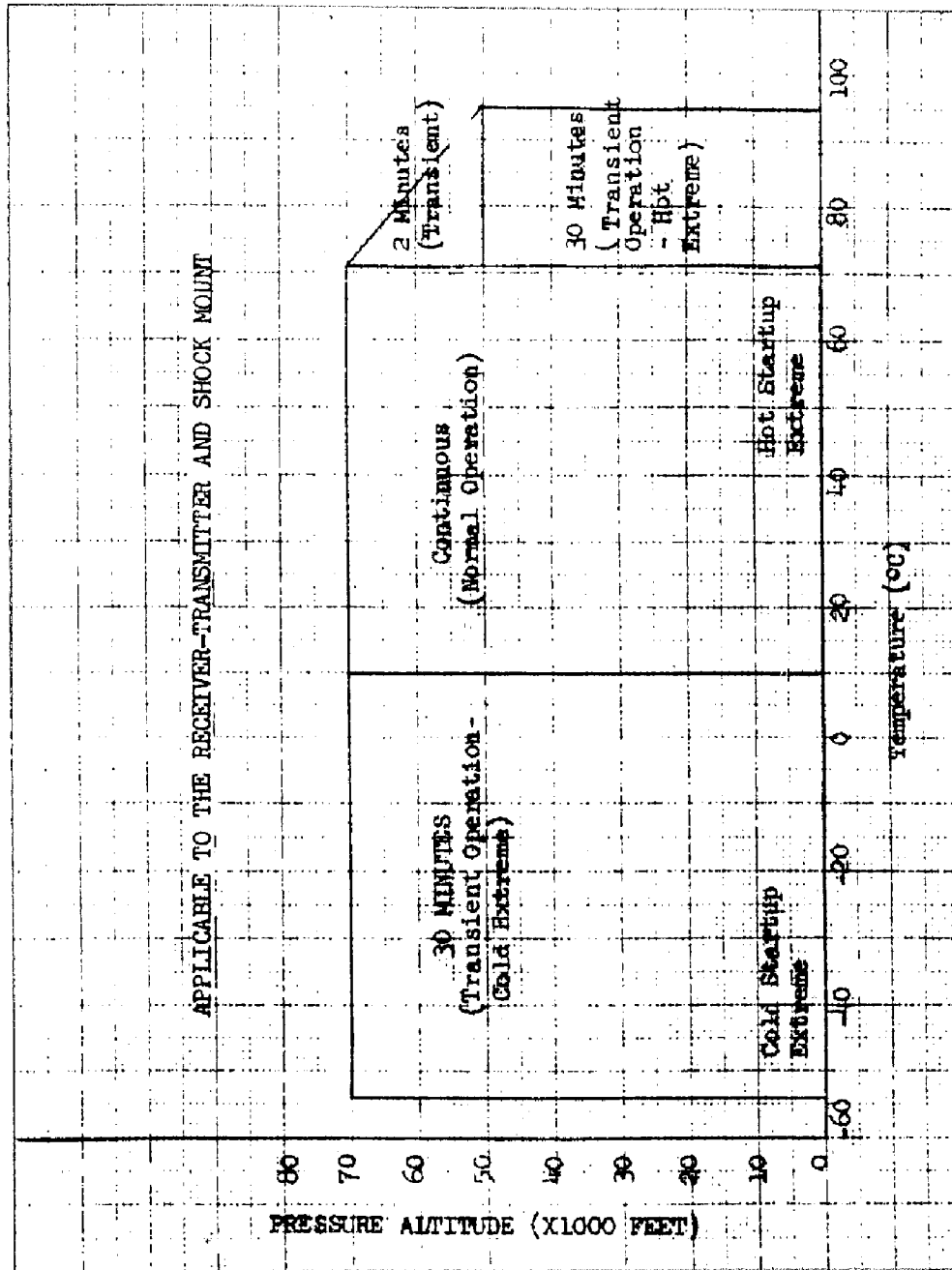


Figure 6

Temperature-Altitude Requirements

**MCDONNELL DOUGLAS**